DOCUMENT RESUME

ED 086 301 JC 740 055

AUTHOR	Kowalski, James A.
TITLE	Southern California Area Environmental Manpower and Training Needs Study.
INSTITUTION	California Community Colleges, Sacramento. Office of the Chancellor.; Coast Community Coll. District, Costa Mesa, Calif.
PUB DATE	Jun 73
NOTE	190p.
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	*Community Colleges; *Curriculum Guides; Educational Needs; *Environmental Technicians; Job Skills; *Manpower Needs; *Occupational Information; Post Secondary Education; State Colleges; Surveys; Technical Reports; Vocational Education
IDENTIFIERS	*Southern California

ABSTRACT

A survey was conducted to identify environmentally related jobs, the current employment need in these areas, the 5-year projection, and the current status of educational training programs to meet the employment needs for technicians or paraprofessionals within a five-county area of Southern California. The environmentally related occupations identified were: Air Pollution Technician, Water and Wastewater Technician, Noise Technician, Occupational Safety and Health Technician, and Ecological or Environmental Resource Technician. The counties surveyed were Los Angeles, Orange, Riverside, San Bernardino, and Santa Barbara. The survey was done by use of form letters, telephone contacts, and personal meetings. Curricula and proposed curricula in the five occupational areas are provided. Appendixes to the report provide the survey data, questionnaire and form letter samples, a list of community colleges and information as to their training programs in the five occupational areas, and job descriptions. (DB)

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SOUTHERN CALIFORNIA AREA ENVIRONMENTAL MANPOWER AND TRAINING NEEDS STUDY

THIS PUBLICATION WAS PREPARED BY THE COAST COMMUNITY COLLEGE DISTRICT IN COOPERATION WITH THE CALIFORNIA COMMUNITY COLLEGES, PURSUANT TO A FUNDING UNDER THE VOCATIONAL EDUCATION AMENDMENTS OF 1968 (PUBLIC LAW 90-576).

JC 740 055

By

JAMES A. KOWALSKI, M.A.

JUNE 1973

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For the past several years there has been a tremendous amount of publicity about the deterioration of the environment. The ecological balance is in a tailspin as a consequence of a highly developed industrial sector and 200 million people. The reality of the problem and the publicity have caused Federal, State and local governments to initiate positive steps to reverse the trend. For the past three years there have been numerous statements by governmental agencies testifying to the vast numbers of professional and para-professional personnel needed to effect the desired changes in the environment.

"By 1980 the rapid population growth will have created environmental problems requiring 214,000 trained technicians."

Since that prediction was made (1971) there has been considerable research done in all the specific areas of environmental employment needs and several similar predictions are available, but not necessary. The implications are the same. Laws have been enacted at the Federal and State levels that have increased the anticipated needs for environmental personnel. From extensive searching done in a five-county area (Santa Barbara, San Bernardino, Los Angeles, Orange and Riverside), five environmentally related occupations were distinguished as having current job availability, projected need and training needs. These occupational needs can be attributed to legislation affecting the respective areas of employment. The occupational areas are: Air Pollution Technician, Water and Wastewater Technician, Noise Technician, Occupational Safety and Health Technician and Ecological or Environmental Resource Technician.

OCCUPATIONAL SAFETY AND HEALTH

The parameters of the Occupational Safety and Health Act of 1971 are so inclusive of the working force that it is somewhat of a foregone conclusion that the employment needs created by this legislation will warrent training programs throughout the country. An Occupational Safety and Health Technician will be employed at the Federal, State, county, city and industrial levels. Approximately 60% of the safety and health problem is the exposure to contaminating chemicals. This is a major cause of the recent more strict laws.

Potential employers are emphatic in their appraisal of the need for safety and health technicians.

Robert Stone Orange County Health Dept. P. O. Box 355 Santa Ana, Calif. 92702	"There is definitely a need for a training program for a health technician. We are considering establishing some sort of program for county personnel."
William Smirl Safety and Health University of Calif. Irvine, Calif. 92664	"The need for safety and health technicians will increase 28% to 30% over the next few years. They will be employed by every large industry, public and private. I can use one more technician to assist us now."

A very recent Department of Labor article (May 4, 1973) is specific in several projections. "An article entitled 'Other People's Business is their Business: Health and Regulatory Inspectors' reports that an average of 2,700 jobs a year will open up through 1980 for inspectors who enforce health and safety regulations and other governmental standards (excluding construction regulations) designed to protect the public welfare. Employment of such workers totaled nearly 120,000 in 1971, with over half working for State and local governments and the rest for Federal agencies."[4]

It is difficult to determine the current need for health technicians in Southern California, but there is a definite projected need that more training will be required than is being offered now.

AIR POLLUTION CONTROL

"In 1971, the Air Programs Office of EPA performed a survey of all state and local air polltuion control agencies to asses their manpower needs. It found there were 4,500 persons employed in 1972 in state and local agencies, and that this number would increase to 8,200 by 1975-76. This survey, however, was limited; it did not get into the needs for air pollution control personnel in industry, nor did it attempt to asses the needs of the federal government."2

It is difficult now to asses the employment needs of California that will be created in air pollution control by the establishment of the guildlines for implementation of the California Enviornmental Quality Act which specifies that an air pollution study must be performed as a pact of the Environmental Impact Report that is required.

WATER AND WASTE WATER

The waste treatment area has a continual need for operators and laboratory technicians. The recent change in laws by the Water Quality Plan for Oceans of California is restricting the discharge of heavy metals and the tests are now being made on the effluent discharge instead of the receiving water. This legislation will further increase the demand for qualified water treatment personnel. An anticipated act of Congress requiring secondary biological treatment will increase the need for laboratory technicians, engineers, chemists, and operators throughout the country.

A survey performed for EPA indicated that the manpower needs in the water category will triple between now and 1976. This reflects the rational need. The EPA is taking big steps to meet this need.

"Gross Manpower and training requirements can be partially fulfilled through activities designed to improve effectiveness and efficiency of the existing labor force, as well as through activities designed to train additional members of that force. Accordingly, EPA has undertaken a number of activities in this area."

The following table is from the same publication which reflects the specific numbers and personnel categories in the waste water treatment area:

TABLE 2

LABOR FORCE GROWTH 1971 TO 1976

Personnel Category	1971 Manpower Engaged	1976 Manpower Requirements	Percentage Increase
Professional	25,400	42,200	66%
Operator	49,300	92,900	88%
Technician	26,900	47,300	77%
Other	47,800	71,800	50%
TOTAL	149,400	258,800	73%

There are 185 training programs at various institutions for higher learning all supported by the Enviornmental Protection Agency. One of these programs at Orange Coast College, headed by Mrs. Pat Taffer, Project Transition Coordinator, has graduated 150 students over the last two years. Of these graduates, 130 have been placed in employment in the waste water field. By November of 1973 the State of California will hire 80 technicians with an Associate in Arts degree to be waste water inspectors. They will be inspecting discharges that will (hopefully) already be treated by other waste water personnel. The Water Quality Act of 1972 requires that industrial waste

discharge not exceed the characteristics of domestic waste. Cities and municipalities that are requesting federal funds for building waste water treatment plants must enforce the industrial standards in order to be eligible for federal financial support.

NOISE ABATEMENT

One of the most neglected areas of Environmental training and control is noise abatement. A variety of studies have indicated that consistant, excessive noise, above 85 dbA, definitely causes damage to hearing and when considerably higher than 85 dbA may cause numerous physiological and emotional problems. This was sufficient evidence for the Walsh-Healy Act which benefits primarily industrial workers. On December 1,1970, the State of California passed legislation requiring every airport in or near a community to monitor its noise levels. The more recent Occupational Safety and Health Law (effective April 28, 1971) covers any employer engaged, in any way, in interstate commerce and has at least two employees. This includes a whole range of unsafe or unhealthy conditions including excessive noise.

Most recently (February 2, 1973) the Guidelines for Implementation of the California Environmental Quality Act were established. These guidelines require an (EIR) Environmental Impact Report to be researched and written for all developments having a significant effect on the environment There are few exceptions to this law. Noise control and abatement is one of thirty-seven areas that the report must cover.

The implications of this legislation are clear. Trade magazines in the field of Accoustics, reflect job openings around the country for all levels of noise abatement personnel. In this Southern California study, professionals in the public and private sectors feel there is a need for a training program, especially at the technical level.

magazines in the field of acoustics reflect job openings around the country for all levels of noise abatement personnel. In this Southern California study professionals in the public and private sectors feel there is a need for a training program, especially at the technical level.

SURVEY PURPOSE

The intention of this survey is to identify environmentally related jobs, the current employment need in these areas, the projection (5 years) and the current status of educational training programs to meet the employment needs for technicians or para-professionals within a five county area of Southern California. The counties are Los Angeles, Orange, Riverside, San Bernardino and Santa Barbara.

It was extremely difficult to get numbers or statistics from potential employers. There seemed to be concern on their part that part of the purpose of this survey was to place people in job positions. Consequently, many people were reluctant to mention current or projected needs. Others who were willing didn't want to be quoted for fear of being recriminated by superiors for suggesting that they were understaffed.

SURVEY TECHNIQUES AND FINDINGS

The research was done using form letters (See Appendix I), telephone surveys and personal meetings. The telephone contacts always included getting information on the following:

1. Are any environment technicians employed?
2. What kind of work are they involved in?
3. What are their educational/training backgrounds?
4. Are more technicians needed?
5. Is a training program necessary to meet the employ-

ment needs?

6. What is the projected estimate of the needs?

Frequently the phone conversation lasted a half an hour or more. Discussion would cover past training programs, work experience, pertinent legislation, the economy's effect on environmental employment and feelings the interviewee had about the results of this survey.

Thirty personal visits to the employer's place of business were made. This was done to establish a "feel" for the type of work being done at the agency and to get advice regarding a curriculum proposal.

During the course of the survey, the State of California established the parameters or "Guidelines for Implementation of the California Environmental Quality Act of 1970". Essentially, it requires an Environmental Impact report to be performed on any proposed development that will have a significant effect on the environment. There are a select few exclusions to this. A total of 37 areas of environmental concern must be researched and submitted as necessary to a complete EIR.

Consequently, an immediate need was generated for professionals and specialists in all the areas of environmental control to prepare these reports. Cities were given the legal right to accept of refuse to accept the report on the basis of their personnel's expertise. Most cities are ill-equipped to perform an objective appraisal of an EIR with their existing staff. Most cities were understaffed by their own admission, prior to this new responsibility of reviewing EIRs. The need for qualified professionals, specialists and technicians doubled. The limitations of

cities to fulfill their employment needs in environmental areas are governed by budgetary restriction. Each city has or will determine how they are going to interpret the State's "Guidelines". How they do so will, in part, be determined by abailable personnel they can afford to hire. If a particular city is especially limited financially, they may decide to review the EIR with existing personnel. Another city might hire or train several specialists to do the same thing. It would appear that an EIR might be of a quality to be rejected in one city and accepted in another. Some city managers and planners don't know how they will interpret the State's guidelines. They are waiting for other cities to set precedence. Some city authorities see this as an opportunity to make money by charging researchers for already researched information. Other city authorities see it as a burden to their already ifsufficient budgets. The city of Los Angeles has the Civil Service exams to cope with. The beaurocracy involved in the Civil Service precludes quick employment. It also requires a Bachelor of Arts degree of personnel doing the type of work required by an EIR. Any influence to change the hiring procedure for the city of Los Angeles was requested in order to permit the hiring of technicians to perform much of the work that professionals are required to do now. This hiring policy is reported to have an influence on the 20 million dollar proposed budget deficit for the city of Los Angeles.

In August of 1973, the State will review the impact of the "Guidelines". Builder organizations are expected to have strong lobbying monies to discourage the finalization of the EIR requirements as they now exist. City management people hope the Guidelines are made more specific. If the Guidelines are firmed up, the need for environmental personnel will be increased. If not, the employment need may diminish for those technicians specifically needed to support the professionals.

Los Angeles and Orange County each has a list of consul-

tants. Ninety-five in all have submitted their names and offered their services in preparing EIR's.

The same questions were asked as in the other phone contacts. In addition these people were asked if the EIR legislation had created a need for existing or new enviornmental technicians.

PRIVATE SECTOR

A recognized authority on the environment, J. Jameson Moore, President of Atlantis Scientific in Beverly Hills, is pessimistic about the need for training environmental personnel.

"The way the Environmental Impact Report Guidelines is established has created a discrepency. The research can be thorough and complete and prepared scientifically and objectively. Then the decision on this quantitative report is a subjective one. Eighty-five percent of the decision can be subjective because the guidelines are too obscure. It will be from 3 to 5 years before we know what is needed and standards are firmly established".

There were a few other employers who felt the same way as Mr. Moore.

The following reflects the feelings of some of the other potential employers in the private sector:

Steve Schwartz Jennings-Halderman-Hood 2001 East 4th St. Santa Ana, Ca. 92705 (Civil Engineering)	"We need multi-disciplined technicians, with knowledge or experience in the building trades, to help our professionals perform research for Environmental Impact Reports. Work experience should be a part of the program."

John Corrough Development Research Asso. 731 South Flower Los Angeles, Calif. 90012 (Economics Research)	"I believe there is a need for a training program at the junior college level as we need technicians now and will in the future. The technician can best serve us if he has a training in several areas related to environmental studies and case histories of enviornmental impact reports. He should have work experience in the researching of information for an environmental impact report expecially in the socio-economic areas."
Dr. Richard Kent Keobig & Koebig 1053 Sunset Blvd. Los Angeles, Calif. 90012 (Civil Engineering)	"I don't think a program for training environmental technicians is needed at the present time. The supply of qualified people still meets the employment demand and will for a year or so."
Mr. Eugene Scothorn Envista, Inc. 125 South Claudia Anaheim, Calif. 92805	"There is a need for training programs. I feel a multi-disciplined technician should be trained to assist our professionals in research drafting and some aspects of writing. We could use one or two of these people now. We would like to send some of our professionals to evening courses to update their skills."
Mr. Murton Willson Danielian, Moon, Sampieri & Ilg. 3848 Campus Dr., Suite 210 Newport Beach, Calif. 92660 (Atchitects, Planners)	"I think there is a need for technicians to do "footwork" research, data collecting and observation- a multi-disciplined background with, perhaps, a speciality in graphics. We could use one or two of them."
Dr. Martin Schwartz Technology Associates of Southern Calif., Inc. 362 W. Garvey Ave. Monterey Park, Calif. 91754 (Engineering & Science Specialists)	"We have used graduates of U.C. Santa Barbara's Environmental Science program to assist our professionals. We could use technicians also. The training should be for multi-disciplined and specialized technicians. A college should easily place 25 to 30 students and the need should increase."

Dr. Lewis Follansbee Environmental Impact Profiles 642 South B Street Tustin, Calif. 92680 (Environmental Research)	"As it stands now, it is mostly the professional-level environmentalist who can analyze, interpret and write the report. These top-level people are needed to utilize the technician. Things are moving slowly, but people are being absorbed. Most firms don't have a full complement of specialists; consequently, consultants are widely used for various aspects of EIR research. My projection is that the demand for technicians is minimal, but will remain consistent. I would recommend a training program, but it shouldn't be over-sold."
Eugene Wheeler Eugene D. Wheeler & Assoc. Urban Health & Environmental Planners 458 Dorothy Avenue Ventura, Calif. 93003	"I currently employ nine technicians to assist the professionals on the staff. I have enough technicians. I feel the missing link is at the higher level--the decision-making level. Generally, there is a need for technicians in the private sector."

The quotes are representative of what was found by surveying 50 of the listed 95 firms. Attempts were made to contact all of the 95, but people were not available for comment or the telephones were no longer in service and there was no new number. The firms contacted were located throughout Los Angeles and Orange counties.

Training should be provided for technicians	Don't know, or possibly training should be offered	No, training should not be offered
31	7	12

PUBLIC SECTOR

A public sector survey was also made with regard to the recent needs created by Environmental Impact Report requirements. The following quotes reflect the employment needs of the respective departments involved in reviewing and performing EIR's:

Robert Kelly Anaheim, Calif. Orange County	"We are going to require the developer to hire a consulting firm to perform the Environmental Impact Report. Our reviewing committee will consist of various department heads--water, fire, etc. We don't anticipate hiring technicians."
Taras Kozber Buena Park, Calif. Orange County	"We don't have the personnel to do Environmental Impact Reports. We will hire a consultant to perform one for the city and request the developer to hire a consultant who can interface his data with ours. I don't think a program is necessary, but we would like seminars offered to existing personnel for updating techniques and knowledge of laws."
William Dunn Costa Mesa, Calif. Orange County	"We will refer the developer to a list of approved consulting firms on a round-robin basis. We will review the report with a committee to make the final decision. We will need 2 to 16 people with the Planning Department in the next 5 years, 5 of which might be at the technical level."
Richard Morton Fullerton, Calif. Orange County	"We will be doing our own preparation and reviews for EIR's using department heads who will review the developer's report. Our people already have adequate expertise. If we don't, we will hire a consultant."
Thomas Severns Huntington Beach, Calif. Orange County	"We will review the EIR's using a review board consisting of department heads. We need support personnel at the technical level. I feel there is a definite need for technicians. I believe 20 to 35 technicians could be placed in positions in western Orange County alone."
Edward Skutnik Long Beach, Calif. Los Angeles County	"Our Building Department will enforce and review the Environmental Impact Reports. I think

there is a definite need for a training program for technicians. I would like to see a 2 year program for training generalists in engineering, sociological, economic and physical science aspects of an EIR."

Mr. Richard Pennock
Pasadena, Calif.
Los Angeles County

"We will have a multi-disciplined team to review environmental impact reports and when needed we will use community specialists. The colleges can help by offering refresher course to help Planning personnel remain current. I would especially like to see courses offered in noise abatement".

SURVEY OF COLLEGES

The survey procedures used to determine the current training programs in the five county area consisted of a form letter, see Appendix II, and a follow-up phone call. The responses reflected in this writing may be outdated at the time of publication. The emphasis on the need for training programs in the environmental field has prompted several colleges to consider offering a training program. The indications reflected in this writing should be helpful in determining what is needed. Environmental employment and training is in a constant state of change. Consequently, any college considering development of the programs recommended in this survey should make the effort of contacting the local private and public sectors to comprehensively estimate how many training slots they should provide for. Enrollment in appropriate course offerings on an evening college basis appears to be an excellent barometer of the need for a complete program offering. Something more schools must do is to send notices and flyers to employers of potential students. The research indicated that many employers were unaware of courses being offered at local colleges.

As more training is needed, more sources of money are expected to be available. The Environmental Protection Agency is pur-

portedly going to offer funds this summer for a noise abatement technician training program in addition to continued financial support for the myriad of existing programs - especially in Water/Wastewater.

In the responses to the survey questionaires, the phone contacts and the personal visits, there was a consistant plea for technicians that are more work-ready than the graduates of some college programs at all levels. The answer to the problem is to incorporate work experience into any direct employment training program, especially in the technical areas. Some employers felt that Master Degree graduates were educated trainees.

It is recommended that work experience slots are most important and the alternate option (if slots are not available) is to offer some sort of practicum encompassing field study, field trips, class or individual projects on industrial problems, model building, etc.

The Orange County Planning Commission and the Los Angeles Planning Commission will be hiring some new personnel but neither expect big employment shortages.

A rather large employment need was expected throughout the public sector as a consequence of the review and performance of the environmental impact reports. However, the response of "no new needs" seemed predominant. Virtually all of the 15 major cities contacted reflected budgetory limitations as a primary factor in explaining responses of limited needs. Several cities that were contacted didn't yet know how they would interpret the State's "Guideline".

Research that was completed prior to the State's action on the EIR guidelines indicated essentially the same training and employment needs, only to a lesser degree. There were marked employment needs in wastewater, Occupations Safety

and Health, Noise Abatement, and Air Pollution Control. The Environmental Resource technician is the child of the State's guidelines for implementing EIRs.

The employer's concept of what a resource techician is supposed to do is less than clear, however. All of them agreed that this person would assist professionals in various areas and perform a good deal of "leg work" that is currently being done by the professionals. However, if this resource technician is employed by a Civil Engineering firm, they will have to orient this person to their special needs as it would be impossible to train a generalist and a specialist in a two year program. It would behoove any of these technicians to consider further college training on a part time basis. The consensus of opinions is that the resource technician will have course work in several areas and especially course work to train him (or her) to know "What is needed" and "where to find it" in terms of public records and other data available. This "leg work" is essential to report preparation.

JOB DESCRIPTION INDEX

The job description index consists of the most commonly referred to titles. Public and private agencies responded to the questionaires with a myriad of job descriptions. There were several different titles with similar or alike descriptions, some of which were misleading. An air pollution technician was referred to as an air pollution investigator, an environmental technician was referred to as an air technician, etc. However, most of these "different" descriptions had very similar education requirements and it appeared appropriate to use the most common job title.

Employment ratings are used in lieu of numbers because of the almost unbelievable change in the significance of numbers. The ratings are somewhat general for that reason. There is more reflected on this phenomenon in the introduction to the Education section. Essentially, the college that is considering the implementation of a program ought to make some kind of local survey.

The projection column resulted from a deliberative process of the advisory committees and the feelings of the employers in the public and private sectors. All of these people agree that the employment in the whole area of ecology is strongly dependent upon legislation and financial commitment from all levels of government.

PROJECTION RATINGS

The employment projection of "Good" indicates that the employment prospects in this area are such that trained people will find work. It indicates current job availability and projected job availability for the next five years or more.

This rating may or may not require a training program depending upon the area. If the jobs are in a large metro-

politan area, (most are) there are several colleges that could be offering a training program or relevant courses to meet the employment needs in that area. A limited survey in the local area of the training institution to estimate the training slots would seem fitting

Other factors generally bearing on the "Good" rating are:

1. There is a program already offered in this area that may or may not meet the employment needs.

OR

2. These positions are filled with a company training program. (This is the case with a major auto manufacturer that trains it's own technicians to monitor the emissions of 20% of their production model cars.)

OR

3. There is good lateral movement possible from similar agencies.

OR

4. Many of these positions have been filled by bachelor degreed personnel or higher levels because the employer is following tradition or Civil Service requirements. This is true to a large degree in the city of Los Angeles.

The rating of "Excellent" indicates that the current and projected employment needs are such that a training program is in order. Generally, the projected need is higher for each year than the current need. Presently, employers may have difficulty filling positions with properly trained personnel.

The rating of "Poor" indicates that the number of job openings in that position are minimal or non-existent and the projection is such that a training program is clearly not in order at this time.

The rating of "Fair" indicates that there are some jobs available, but the turnover is minimal and job openings sporadic. The employment needs are such that while a training program is not recommended, appropriate evening courses may be recommended. The projection for these jobs is parallel to the current needs. There will continue to be sporadic openings. In some cases there are already programs of one sort or another training people for employment in the areas rated fair.

ADVISORY COMMITTEE

NOISE ABATEMENT

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Noise Abatement Technician Curriculum

Purpose of the Curriculum: Courses offered in this program are designed to prepare students for entry into the fields of industrial, architectural, and enviornmental acoustics as well as noise abatement at the technical level.

Course Structure and Organization: Twenty-four units of specialized noise abatement and acoustical instruction, evenly divided between laboratory and theory, afford a balanced core of technical development. These are supported by twenty additional required units in related subject areas such as technical mathematics, elementary electronics, computer technology, drafting and mapping, technical report writing and graphical display of data.

The balance of this four semester sequency consists of supplemental course work in social science, humanitites, psychology and other suitable general education electives comprising sixteen additional units leading to the A.A. degree, if desired, upon attainment of approximately sixty units.

Topic Outline: Requirements in the major area consist of the following courses:

NA-1	Introduction to Theory of Sound	(3 units)
NA-2	Acoustic Laboratory Principles	(4 units)
NA-3	Physiology & Psychology of Hearing	(1 unit)
NA-4	Theory of Sound Measurement	(3 units)
NA-5	Sound Measurement Laboratory	(4 units)
NA-6	Methods of Acoustical Measurement	(3 units)
NA-7	Acoustical Instrumentation Practice	(4 units)
NA-8	Legal and Architectural Standards of Noise Abatement	(2 units)
	Total Units in Major	24 units
NA-9	Technical Mathematics of Sound I	(3 units)
NA-10	Technical Mathematics of Sound II	(3 units)
NA-11	Elementary Electronics	(4 units)
NA-12	Computer Technology	(3 units)
NA-13	Drafting and Mapping	(2 units)
NA-14	Graphical Display of Acoustical Data	(2 units)
NA-15	Technical Report Writing	(3 units)
	Total Supportive Requirements	20 units

General Education Requirements Could Consist Of:

Social Science	(3 units)
Humanities	(3 units)
Psychology	(3 units)
Electives	(6-8 units)
Total General Education Requirements	(15-17 units)

NA-1 Introduction to Theory of Sound

Course Description

3 units

Description of Course: A math-oriented, non-calculus examination of theory and principles of application concerning the following features of sound with respect to measurement and interrelationships.

Vibration
Simple harmonic motion
Wave phenomena
Energy
Propagation
Amplitude
Frequency
Wave length
Velocity
Conduction
Reflection and Echoes
Absorption
Resonance and interference
Refraction
Sound vs. Noise
Hearing
Loudness
Pitch
Discrimination
Weber's Law
Fechner's Law
Phons
Sones
Decibels
Decibels - absolute energy
Decibels - reference noise
Sound pwoer
Ambient noise
Threshold of hearing
Range of audibility
Curves and Graphs

Prerequisites: Mandatory concurrent enrollment in Technical Math. of Sound I.

NA-2 Acoustic Laboratory Principles

4 units

Description of Course: An introduction to laboratory operation of professional acoustical equipment combined with an elementary physics-oriented exploration of sound phenomena involving mathematical analysis.

The following topics are treated:

Standing Waves
Resonance
Determination of:
- Velocity
- Wave-LTH
- Frequency

Media for Propagation
- Gas & Solids

Measurement Criteria
- Intensity
- Loudness
- Sound Pressure Level
- Calibration of Instruments

Frequency Analysis
Sound Power Measurement
Sound Intensity Ratios

Recording of Measurements
Charts, Graphs, Tables
Logarithmic and Semi-log Tape & Graphic Recorders

Prerequisites: Mandatory concurrent enrollment in NA-1, Introduction to Theory of Sound.

NA-3 Physiology and Psychology of Hearing

1 unit

Description of Course: An elementary examination of the morphology and function of the human ear within the context of the aural environment. Topics to be covered are:

Structure and Function of the Ear
Detection of Energy
Response to Stimulus
Loudness Discrimination
Frequency Discrimination
Range of Response
Recognition - Identification Faculties
Neural Processes and Properties
Place Theory of Functional Detection
Perception of Noise Level
Psycho-Acoustical Attributes of Sound
Perception of Nominal Scale
Perception of Interval Scale
Perception of Ratio Scale
Annoyance Levels
Tolerance Levels
Effect upon Human Behavior
Aural Health and Hygiene
Damage to Hearing
Tinnitus
Hearing Loss
Protection of Hearing
Deafness

Texts: Waves and the Ear, Bergeijk, Pierce and David, Anchor Books, Doubleday & Co., Garden City, New York 1960.

NA-4 Theory of Sound Measurement

3 units

Description of Course: A math-oriented introduction to theory and practice involved in measurement of sound phenomena as encountered in technical analysis in the field and laboratory.

The topics examined are:

- Measurement Principles
- Measurement of Sound Parameters
  - Loudness - Sound pressure level
  - Decibels (and reference parameters)
  - Absolute energy units
  - Logarithmic relationship to intensity
- Units of Threshold Pressure
- Units of Threshold Intensity
- Relationships involving the above (i.e., density, velocity, impedance)
- Addition of separate intensity combinations
- Addition of Separate Pressure Levels

- Sound Level Meters
  - Calibration
  - Weighted Scales

- Sound Analysis - Frequency
  - Filters and Their Use
  - Octave, Half-Octave and Third-Octave Analysis

- Sound Power & Sound Intensity
  - Loudness
  - Phons
  - Sones
  - Their Relationships

- Ambient Noise Measurement
  - Sound Pressure Level and Frequency
  - Total Noise
  - Background Noise
  - Spectrum Level
  - Reduction Level

Prerequisites: NA-2, Acoustic Laboratory Principles
NA-3, Physiology and Psychology of Hearing
Technical Math of Sound 1
Mandatory enrollment in Technical Math of Sound 2

NA-5 Sound Measurement Laboratory

4 units

Description of Course: A laboratory approach to the application, operation, maintenance and calibration of acoustical equipment with emphasis upon the determination and systematic compilation of data as required by specific job situations.

Topic Outline:

Microphones
Oscillators
Amplifiers
Speakers
Sound Generators
Sound Level Meters
Impact Noise Analyzer
Noise Exposure Monitors
Calibrators
Octave Band Meters
Wave Analyzers
Graphic Level Recorder

Set-up, Calibration, Adjustment and operation of the above.

Charts and Criteria
Standards of Comparison
Noise Criteria
Ambient Noise
Octave Band-Width Analysis

Prerequisites: NA-1 through NA-3 and Mandatory concurrent enrollment in NA-4, Theory of Sound Measurement.

NA-6 Methods of Acoustical Measurement

3 units

Description of Course: An integrated, in-depth approach to the recognition of data required for specific sound analyses and the method, instrumentation, and data display required to produce professional data and reports.

The following features are systematically considered with respect to measurement and procedural method requirements.

Noise Criteria and Classification
Noise Analysis
Intensity-Duration Relationships
Ambient Considerations
Pulse Testing, Impulse Analysis
Reverberation
Use of Tape Recorders

Use of C illoscope and photography
Structural Considerations
Room Acoustics
Industrial Noise
Traffic Noise
Aircraft Noise
Product Noise Analysis
Consumer Oriented Measurement Data

Prerequisites: NA-4, Theory of Sound Measurement
NA-5, Sound Measurement Laboratory

NA-7 Acoustical Instrumentation Practice

4 units

Description of Course: A comprehensive consideration based upon integrated employment of sound testing equipment to fulfill specific job requirements with emphasis upon on-site experience.

The following topics will serve as a guide but individual field situations will dictate the detailed procedures and appropriate activity:

Architectural Acoustic Analysis
Survey, Evaluate, Set-up and measure pertinent features of each of the following; selecting appropriate on-campus locations and facilities as follows:

Project 1. A working business office.
Project 2. An auditorium or rehearsal facility in operation.
Project 3. Acoustically analyze a large lecture hall; particular emphasis to be placed on reverberation and critical areas.

Industrial Acoustic Analysis
A Working Machine Shop

Project 4. Measure sound pressure levels, ambient noise, transient noise, impulse noise, wide band noise, etc.
Project 5. Analyze and measure traffic noise at a suitable location on campus. Plot sound level contours for appropriate hours and position. Put data in suitable form so as to determine and display peak conditions. Indicate areas not suitable for classroom locations.

Project 6. Student to select a feasible on-campus project which interests the student as a professional technician. The effort should result in concrete evaluation of data to permit meaningful display, evaluation and result in acoustical improvement or suggestions for noise abatement.

Prerequisites: NA-1 Through NA-5 and Concurrent enrollment in NA-6.

NA-8 Legal and Architectural Standards of Noise Abatement

2 units

Description of Course: A study of current federal, state, county and local regulations for industrial and environmental hoise abatement. Also included are architectural acoustic standards for public and private buildings.

Topics to be Included are:

- Acoustical specifications
- Industrial acoustic requirements
- Environmental Acoustic requirements
- Architectural acoustic requirements
- Consumer-product noise specifications
- Inspection, Procedural and Measurement criteria
- Federal, state, county and local regulation
- Legislative and enforcment agencies
- Consideration of Health safety comfort
- Economic aspects of noise pollution
- Automobile exhause noise pullution

Prerequisites: Introduction to Theory of Sound
Acoustic Laboratory Principles

WATER AND WASTEWATER TECHNOLOGY

This curriculum is patterned after the curriculum set forth in Water and Wastewater Technology, Technical Education Program Series No. 11, U.S. Government Printing Office, Washington; 1968. If implementation of this curriculum is undertaken, it is recommended that the original publication be used as a further source for curriculum, reference and supplementary materials. This adaptation was approved by the following advisory committee.

ADVISORY COMMITTEE

Mr. Theodore A. Dunn Head of Operations and Laboratories	Orange County Sanitation District P.O. Box 8127 Fountain Valley, Ca. 92708
Mr. Fred Harper Manager	Orange County Sanitation District 14088 Ellis Street Fountain Valley, Ca. 92708
Mr. Norman Barnette	L. A. County Sanitation District 24501 S. Figueroa Harbor City, Ca. 90710
Mr. Carl Nagel Superintendent of Treatment	L. A. County Sanitation District 24501 S. Figueroa Harbor City, Ca. 90710
Mr. Carl Connor	Sewage Treatment Facility 5950 Acorn Street Riverside, Ca. 92503
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Mr. George Tapper	Moulton Niguel Water District 3 Monarch Bay Plaza Suite 102 Laguna, Niguel, Ca.
Mr. Gil Cleveland	City of Corona City Hall - 815 West 6th Street Corona, Ca. 91720
Mr. Marvin Martin	Escondido Wastewater Treatment Plant 100 Valley Boulevard Escondido, Ca. 92025

ADVISORY COMMITTEE (cont'd)

WASTEWATER & WATER TECHNOLOGY

Mr. Bill Clark	Orange County Sanitation District 14088 Ellis Street Fountain Valley, Ca. 92708
Mr. Bill Garber Asst. Chief Engineer	Hyperion Treatment Plant 1200 Vista del Mar Playa del Ray, Ca. 90291
Mr. George P. Callahan	Hyperion Treatment Plant 1200 Vista del Mar Playa del Ray, Ca. 90291
Mr. Gerald Baldwin President	Orange County Sanitation District Santa Ana River Basin Section P. O. Box 8127 Fountain Valley, Ca. 92677

POLLUTION ABATEMENT TECHNICIAN

WATER AND WASTEWATER

SUGGESTED TWO-YEAR PROGRAM

Freshman

First Semester

COURSE	UNITS
INTRO TO WATER, WASTEWATER & RELATED TECHNOLOGIES	3
MATH 040	3
TECH REPORT WRITING	3
BASIC HYDRAULICS FOR WATER AND WASTEWATER TECHNOLOGY	4
GENERAL EDUCATION ELECTIVE	3
P.E.	1
	17

Second Semester

MICROBIOLOGY FOR WATER AND WASTEWATER TECHNOLOGY	4
SANITARY CHEMISTRY & MICROBIOLOGY I	4
WATER SUPPLY & WASTEWATER CONTROL	3
GENERAL EDUCATION ELECTIVE	4
P.E.	1
	15

Sophomore Year

First Semester

SANITARY CHEMISTRY & MICROBIOLOGY II	4
WATER PURIFICATION	3
WORK EXPERIENCE	4
ELECTIVE	3
P.E.	1
	15

Second Semester

WASTEWATER TREATMENT	4
INSTRUMENTATION & CONTROLS	3
WORK EXPERIENCE	4
ELECTIVE	3
P.E.	1
	15

Introduction to Water and Wastewater
Technology and Related Fields
Course Description

(18 week course) 3 units

Prerequisite: None

Catalog Description: A study of methods of disease transmission, hygienic excreta disposal, municipal and industrial wastewater collection and treatment, characteristics of water, water treatment, protection of ground water, insect and rodent control, solid waste collection and disposal, milk and food sanitation, swimming pool sanitation, and industrial hygiene. 2 hours lecture, 3 hours laboratory per week.

For whom is the Course Intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the Course: To know and understand the fundamental principles of environmental control, water and wastewater, and sanitation normally employed in the field of public health for protecting the health and well being of people. To know and understand the methods of disease transmittal. To know and understand the physical, chemical, and biological means of prevention or minimizing the threat of pathogens and nuisance organisms as they relate to water resources and water pollution control.

Instructional Methods proposed: Lecture, laboratory, project reports, problem solving and field trips.

Topic Outline:

	MAJOR DIVISIONS	Hours Class	Hours Lab & Eval
I.	Disease Transmittal	6	3
II.	Hygienic Excreta Disposal	6	9
III.	Sources, Protection, and Treatment of Water	6	9
IV.	Insect and Rodent Control	3	3
V.	Solid Wastes, Collection, and Disposal	3	6
VI.	Food Sanitation	3	6
VII.	Swimming Pool Sanitation	3	6
VIII.	Industrial Hygiene	3	6
IX.	Radiological Sanitation	3	6
	Total	36	54

I. Disease Transmittal
   A. Units of Instruction
      1. Air
      2. Food, water, solids
      3. Insects and animals

B. Laboratory Projects
1. Visit laboratory section of local health department

II. Hygienic Excreta Disposal
A. Units of Instruction
1. Purpose
2. Basic Principles
3. Decay cycles
4. Excreta disposal without water carriage
5. Excreta disposal with water carriage
6. Municipal sewage disposal

B. Laboratory Projects
1. Observe and report on the design features of a septic tank under construction.
2. Prepare a flow sheet for a municipal wastewater plant complete with rate, time, and type of treatment process.
3. Prepare a preliminary design of a wastewater treatment facility for a small community.

III. Sources, Protection, and Treatment of Water
A. Units of Instruction
1. Desired qualities
2. Sources
3. Protection
4. Water treatment
B. Laboratory Projects
1. Prepare a flow sheet for a municipal water treatment plant complete with rate, time, name of various treatment processes.
2. Observe construction of private water system and municipal water system, and report on the principal differences in sizes and materials.

IV. Insect and Rodent Control
A. Units of instruction
1. Basic principles
2. Specific insects
3. Rodents
4. Rodent control

V. Solid Wastes, Collection, and Disposal
A. Units of Instruction
1. Solid wastes
2. Collection
3. Disposal
B. Laboratory Projects
1. Inspect, with the local sanitarian, a private waste collection and disposal system
2. Visit a municipal solid waste disposal site and prepare a report on area required and costs.

VI. Food Sanitation
- A. Units of Instruction
  1. Factors affecting health
  2. Food infectants and intoxicants
  3. Control methods used by restaurants
  4. Control methods used by U.S. Government
- B. Laboratory Projects
  1. Inspect, with sanitarian, a milk producing and bottling plant
  2. Observe Federal meat inspector examining animals at a local poultry plant or abatoir.
  3. Observe sanitarian inspecting a food serving establishment

VII. Swimming Pool Sanitation
- A. Units of Instruction
  1. Infections and diseases associated with swimming pools
  2. Water sanitation standards for swimming pools
  3. Methods of purification:
  4. Provisions for safety
- B. Laboratory Projects
  1. Perform chlorine and alkalinity determinations for a swimming pool.
  2. Calculate filtration and turnover rate from data on recirculation pump.

VIII. Industrial Hygiene
- A. Units of Instruction
  1. Industrial hazards
  2. Specific toxic compounds
  3. Methods of control
- B. Laboratory Projects
  1. Visit atmospheric sampling station for information on equipment and operation.
  2. Describe analyses of air samples.

IX. Radiological Sanitation
- A. Units of Instruction
  1. Radioactivity terms
  2. Units of radiation and radioactivity
  3. Effects of radiation
  4. Safety measures
- B. Laboratory Projects
  1. Demonstrate survey type radiological instruments.
  2. Demonstrate radiation from a radioactive substance

Microbiology for Water and
Wastewater Technology
Course Description

(18 week course) 3 units

Prerequisite: None

Catalog Description: A basic course in microbiology with emphasis on microorganisms, and on the laboratory procedures for identifying and differentiating organisms peculiar to water and wastewater treatment, and related public health and stream sanitation problems.
2 hours lecture, 6 hours lab per week.

For Whom is the course intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the course: To know and understand the fundamentals of microbiology pertinent to water and wastewater treatment. The nature and behavior of micro-organisms are basic to the entire operation of waste treatment plants. They must be thoroughly understood before adequate design and operation can be comprehended. The subject matter includes the life processes of organisms, the sanitary significance of each, the specific disease caused by each, and the observation and control of organisms.

Instructional Methods proposed: Lecture, Laboratory exercises, Problem Solving

Topic Outline:

	MAJOR DIVISIONS	Hours	
		Class	Laboratory
I.	Scope and Service	2	3
II.	The Nature of Life	2	6
III.	The Living Cell	3	6
IV.	The Life Processes of the Cell	3	3
V.	Observations of Micro-organisms	4	9
VI.	Bacteria	3	12
VII.	Fungi	2	9
VIII.	Algae	4	9
IX.	Protozoa	2	9
X.	Microbic Infections	2	3
XI.	Microorganism Control	3	9
XII.	Higher Animals	2	9
XIII.	Plankton Enumeration in Water	2	12
XIV.	Botom-Fauna Samples	2	9
	Total	36	108

I. Scope and Service
   A. Units of instruction
      1. The scientific method
      2. Classifications
      3. Biology in service of man

II. The Nature of Life
   A. Units of Instruction
      1. Characteristics of living matter
      2. Introduction to classification
   B. Laboratory Projects
      1. Observe and study proper care and use of microscope.
      2. Examine a specific organism to illustrate all features of a microscope.

III. The Living Cell
   A. Units of Instruction
      1. Sizes, shapes, and types
      2. Parts of animal cell
      3. Parts of plant cell
      4. Cell reproduction
      5. Chromosomes
   B. Laboratory Projects
      1. Study prepared slides for specific parts of plant cells.
      2. Study prepared slides for specific parts of animal cells.

IV. The Life Processes of the Cell
   A. Units of Instruction
      1. Photosynthesis
      2. Oxygen production
      3. Cell metabolism
      4. Interdependence of plants and animals

V. Observation of Microorganisms
   A. Units of Instruction
      1. Microscope
      2. Slide stains--bacteria
      3. Hanging-drop slide
      4. Sample concentration
   B. Laboratory Projects
      1. Prepare a gram stain of known culture.
      2. Prepare an acid-fast stain of a known culture.
      3. Prepare a flagella stain of a known culture.
      4. Identify unknown culture.

VI. Bacteria
   A. Units of Instruction
   B. Laboratory Projects
      1. Prepare bacterial cultivation media.
      2. Adjust acidity of culture media.
      3. Determine plate count on nutrient agar.
      4. Determine M.P.N. (most probable number) on lactose broth.
      5. Determine count on membrane filter.
      6. Prepare pure culture on nutrient agar.

VII. Fungi
- A. Units of Instruction
  1. General
  2. Major divisions
  3. Characteristics
  4. Microscopic identification
- B. Laboratory Projects
  1. Prepare a pure fungi culture.
  2. Classify the protist by morphological details.

VIII. Algae
- A. Units of Instruction
  1. Definition
  2. Classification
  3. Identification
  4. Sanitary significance
- B. Laboratory Projects
  1. Prepare a hanging drop slide of known algae.
  2. Classify an unknown algae by the hanging-drop slide method.

IX. Protozoa
- A. Units of Instruction
  1. General
  2. Identification
  3. Major classes
  4. Species of interest
- B. Laboratory Projects
  1. Examine prepared known slides of protozoa which have sanitary significance.
  2. Prepare wet sample of activated sludge and identify all protozoa.

X. Microbic Infections
- A. Units of Instruction
  1. Skin
  2. Mouth and throat
  3. Intestinal tract

XI. Microorganism Control
- A. Units of Instruction
  1. Physical controls
  2. Chemical controls
  3. Antibiotic and chemotherapeutic controls
- B. Laboratory Projects
  1. Demonstrate effect of osmosis on microorganisms.
  2. Determine heat tolerance of microorganisms.
  3. Compare effect of chemical agents on microorganisms.

XII. Higher Animals
- A. Units of Instruction
  1. Rotifera
  2. Crustacea
  3. Worms and larvae

B. Laboratory Projects
   1. Observe and sketch a known worm specimen.
   2. Isolate and identify rotifera in a water sample.
   3. Study morphological feature of crustacea.

XIII. Plankton Enumeration in Water
   A. Units of Instruction
      1. Collection
      2. Concentration of sample
      3. Examination
      4. Calculation of results
   B. Laboratory Projects
      1. Prepare a standard algae count by use of the Sedgwick-Rafter funnel.
      2. Check results of Sedgwick-Rafter funnel by use of the membrane filter.

XIV. Botom-Fauna Samples
   A. Units of Instruction
      1. Collection
      2. Concentration
      3. Examination
      4. Calculation
   B. Laboratory Projects
      1. Sample bottom deposits of flowing and still streams for organisms.
      2. Compare the type of organisms found in flowing and still streams.
      3. Identify several organisms and check their sanitary significance.

Sanitary Chemistry and Microbiology I
Course Description

(18 week course) 4 units

Prerequisite: Microbiology for Water and Wastewater Technology

Catalog Description: Theory and laboratory techniques for all control tests of water purification including: bacteriology, color, turbidity, pH, alkalinity, hardness, coagulations, detergents, chlorides, flourides, iron, manganese, bactericides, and nitrates.
2 hours lecture, 6 hours laboratory.

For Whom the Course is Intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the Course: To know and understand laboratory procedures as applied to water analysis and purification. Test results will be correlated with specific plant design and/or process control problems for waters in the immediate area.

Instructional Methods proposed: Lecture, Laboratory exercises, Problem Solving

Topic Outline:

	MAJOR DIVISIONS	Hours Class & Eval	Hours Lab & Eval
I.	Introduction	4	8
II.	Turbidity	2	4
III.	Color	2	6
IV.	Hydrogen-ion Concentration: pH	2	6
V.	Alkalinity	2	6
VI.	Coagulation	4	15
VII.	Hardness	2	6
VIII.	Chlorides	2	6
IX.	Flourides	3	9
X.	Iron and Manganese	3	9
XI.	Bacteriology	4	15
XII.	Detergents	3	9
XIII.	Nitrogen	3	9
	Total	36	108

I. Introduction
   A. Units of Instruction
      1. Chemical measurements
      2. Standard solutions
      3. Bacteria
   B. Laboratory Projects
      1. Orient the students in the care and use of and analytical balance.
      2. Prepare a normal solution.
      3. Prepare a molar solution.
      4. Prepare specific laboratory reagents to be used in subsequent laboratory projects.

II. Turbidity
    A. Units of Instruction
        1. Constituents
        2. Significance
        3. Methods of determination
        4. Expression and application of results
    B. Laboratory Projects
        1. Determine turbidity by Jackson candle turbidimeter, and color discs of raw, settled and tap water.
        2. Determine turbidity of raw water, using prepared standards.

III. Color
    A. Units of Instruction
        1. Sources
        2. Significance
        3. Methods of determination
        4. Expression and application of results
    B. Laboratory Projects
        1. Determine color of raw, settled, and tap water, using prepared standards.
        2. Determine color of raw water, using color discs.

IV. Hydrogen-ion Concentration: pH
    A. Units of Instruction
        1. Theory
        2. Measurement
        3. Significance
    B. Laboratory Projects
        1. Determine hydrogen-ion concentration in raw, settled, and tap water by the colorimetric method.
        2. Determine hydrogen-ion concentration in rain water by the electrometric method.

V. Alkalinity
    A. Units of Instruction
        1. General
        2. Methods of determination
        3. Expression and application of results
    B. Laboratory Projects
        1. Determine components of alkalinity, using raw, settled, and tap water as indicator solutions.
        2. Demonstrate alkalinity of water, using methyl orange as an indicator.

VI. Coagulation
    A. Units of Instruction
        1. Purposes
        2. Coagulants used
        3. Stoichiometric equation
        4. Coagualtion control
        5. Coagulant aids

B. Laboratory Projects
   1. Perform the standard jar test on two or more sources or raw water with two or more coagulants.
   2. Visit local water plant and compare results of laboratory coagulant test with operating results.
   3. Determine effect of coagulant aids on the standard jar test.
   4. Perform a cost analysis of coagulation based on chemical performance in a standard jar test.

VII. Hardness
   A. Units of Instruction
      1. General
      2. Causes and sources of hardness
      3. Methods of determination
      4. Types of hardness
   B. Laboratory Projects
      1. Determine hardness of two sources of water by soap method.
      2. Determine hardness of two sources of water by E.D.T.A. titration.

VIII. Chlorides
   A. Units of Instruction
      1. General
      2. Methods of determination
      3. Application of results
   B. Laboratory Projects
      1. Determine chlorides in two sources of water by the Mohr and the mercuric nitrate methods.
      2. Demonstrate chlorides in water, using silver nitrate.

IX. Fluorides
   A. Units of Instruction
      1. General
      2. Types used in water supplies
      3. Methods of determination
      4. Application of results
   B. Laboratory Projects
      1. Prepare colorimetric standards for the determination of fluorides.
      2. Determine fluorides by Megregian-Maier method.
      3. Determine fluorides by Scott-Sanchis method.
      4. Check results of fluoride test with spectrophotometer.

X. Iron and Manganese
   A. Units of Instruction
      1. General
      2. Iron determination
      3. Manganese determination
      4. Application of results
   B. Laboratory Projects
      1. Determine iron concentration in two sources by the phenanthroline and tripyridine methods.
      2. Determine manganese concentration in two sources by the persulfate and periodate methods.
      3. Check results of previous laboratory sessions on iron and manganese by spectrophotometer.

XI. Bacteriology
- A. Units of Instruction
  1. General
  2. Water bacteria: coliforms
  3. Total counts
  4. Presumptive coliform test
  5. Confirmed coliform test
  6. Coliform density
- B. Laboratory Projects
  1. Familiarize the student with the special glassware, dilution principles, and reading equipment used in bacteriology.
  2. Prepare lactose broth, nutrient agar, and other special bacteriological media.
  3. Perform a standard-plate count.
  4. Perform a multiple-tube fermentation test.
  5. Perform a membrane-filter test.

XII. Detergents
- A. Units of Instruction
  1. General
  2. Treatability
  3. Methods of determination
  4. Sanitary significance
- B. Laboratory Projects
  1. Determine detergents by methylene-blue method.
  2. Determine detergents by spectrophotometer.

XIII. Nitrogen
- A. Units of Instruction
  1. General
  2. Sanitary significance
  3. Methods of analyses
  4. Application of results
- B. Laboratory Projects
  1. Determine nitrogen by nesslerization in two samples of water from different sources.
  2. Determine nitrogen by distillation in two samples of water from different sources.

Sanitary Chemistry and Microbiology II
Course Description

(18 Week Course) 4 units

Prerequisite: Sanitary Chemistry and Microbiology I

Catalog Description: A study of the theory and laboratory techniques for the determination of solids, dissolved oxygen, oxygen consumed, relative stability, bacteria, biochemical oxygen demand, organic nitrogen, volatile acids, and toxic metals in liquid media. The course includes stream studies and in-plant studies. 2 hours lecture, 6 hours lab.

For whom is the course intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the Course: To know, understand and be able to perform with assurance laboratory tests needed to evaluate wastewater treatment methods, operational practices, and the effect of wastewater on a water source. Test results will be correlated with specific design and/or operational practices and problems of wastewater disposal plants and streams in the immediate area.

Instructional Methods proposed: Lecture, Laboratory exercises, Problem Solving

Topic Outline: MAJOR DIVISIONS

		Hours	
		Class & Eval	Lab & Eval
I.	Solids	2	9
II.	Dissolved Oxygen	3	6
III.	Chemical Oxygen Demand	3	6
IV.	Relative Stability	3	6
V.	Biochemical Oxygen Demand (B.O.D.)	4	12
VI.	Wastewater Bacteriology	4	9
VII.	Nitrogen	2	6
VIII.	Volatile Acids	2	9
IX.	Grease	2	9
X.	Toxic Metals	4	12
XI.	Radiological Detection	3	9
XII.	Stream Studies	4	15
	Total	36	108

I. Solids
- A. Units of Instruction
  1. General
  2. Total solids
  3. Solids analyses
  4. Application of results

B. Laboratory Projects
   1. Determine the total volatile and fixed residue of a wastewater sample.
   2. Determine the volatile and fixed suspended residue of a wastewater sample
   3. Determine the dissolved matter of a wastewater sample.
   4. Determine the settleable matter of a wastewater sample.

II. Dissolved Oxygen
   A. Units of Instruction
      1. Significance
      2. Sampling
      3. Tests
      4. Application of results
   B. Laboratory Projects
      1. Determine dissolved oxygen by Winkler method of effluent of all processes of municipal waste plant.
      2. Check dissolved oxygen determination for interfering substances by the Rideal-Stewart and alkali-hypochlorite modification.
      3. Check all determinations by use of electrometric dissolved oxygen probe.

III. Chemical Oxygen Demand
   A. Units of Instruction
      1. Theory
      2. Tests
      3. Application of results
   B. Laboratory Projects
      1. Determine chemical oxygen demand of two sources of wastewater.
      2. Determine chemical oxygen demand of untreated domestic wastewater.

IV. Relative Stability
   A. Units of Instruction
      1. Theory
      2. Tests
      3. Application of results
   B. Laboratory Projects
      1. Determine the relative stability of several waste treatment plant effluents and compare results.
      2. Determine the relative stability of untreated domestic wastewater.

V. Biochemical Oxygen Demand (B.O.D.)
   A. Units of Instruction
      1. General
      2. Tests
      3. Application of results
   B. Laboratory Projects
      1. Prepare B.O.D. dilution water.
      2. Set up appropriate dilution on effluent of all processes of local waste treatment plant.
      3. Standardize thiosulfate.
      4. Titrate samples with thiosulfate and calculate B.O.D.

VI. Wastewater Bacteriology
- A. Units of Instruction
  1. Purpose
  2. Types of tests
  3. Interpretation of results
  4. Application of results
- B. Laboratory Projects
  1. Prepare dilutions of sample to cover wide range of bacterial counts.
  2. Determine the M.P.N. of a wastewater sample by the lactose broth fermentation tube method.
  3. Prepare a standard plate count on a wastewater sample.
  4. Determine by appropriate tests the reduction of coliform bacteria through the municipal waste treatment plant.

VII. Nitrogen
- A. Units of Instruction
  1. General
  2. Ammonia nitrogen
  3. Nitrate nitrogen
  4. Nitrite nitrogen
  5. Organic nitrogen
  6. Application of nitrogen
- B. Laboratory Projects
  1. Determine ammonia nitrogen by distillation and nesslerization in raw wastewater sample.
  2. Determine nitrate nitrogen by brucine and phenoldisulfonic methods in raw wastewater sample.
  3. Determine nitrite nitrogen in raw wastewater sample by means of a spectrophotometer.

VIII. Volatile Acids
- A. Units of Instruction
  1. General
  2. Test methods
  3. Application of test results
- B. Laboratory Projects
  1. Determine volatile acids in a digestor sample by the direct distillation method.
  2. Repeat #1, using the steam distillation method.

IX. Grease
- A. Units of Instruction
  1. General
  2. Test methods
  3. Application of test results
- B. Laboratory Projects
  1. Determine grease content of domestic wastewater and an industrial water waste by the Soxhlet and semiwet methods.
  2. Determine grease content of river or marsh water.

X. Toxic Metals
   A. Units of Instruction
      1. General
      2. Preliminary treatment
      3. Test methods
      4. Application of results
   B. Laboratory Projects
      1. Determine total chromium in a metal plating waste sample.
      2. Determine nickel concentration in a metal plating waste sample.
      3. Determine zinc concentration in a metal plating waste sample.

XI. Radiological Detection
   A. Units of Instruction
      1. General
      2. Ionization
      3. Sample collection
      4. Counting instruments
      5. Expression of results
      6. Alpha and beta radioactivity
      7. Strontium
      8. Application of results
   B. Laboratory Projects
      1. Familiarize the student with the equipment, using samples with known radiological counts.
      2. Prepare samples for counting.
      3. Determine total alpha and gross beta activity.
      4. Determine strontium-90 content in raw and treated water in a local treatment plant.

XII. Stream Studies
   A. Units of Instruction
      1. Purposes
      2. Sampling devices
      3. Concentration of microscopic organisms
      4. Oxygen balance
      5. Application of study data
   B. Laboratory Projects
      1. Determine flow of streams by velocity meters and cross sectional areas.
      2. Run plankton counts on stream above pollution entrance, and several places below.
      3. Check bottom fauna above point of pollution and in several places below.
      4. Determine dissolved oxygen and B.O.D. above point of pollution and in several places below.

Water Supply and Wastewater Control
Course Description

(18 week course) 3 units

Prerequisite: None

Catalog Description: This course is designed to familiarize the student with the elementary engineering aspects of design, operation, process control, and maintenance of wastewater treatment plants and facilities. 2 hours lecture, 3 hours laboratory.

For whom is the course intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the Course: To know and understand the engineering aspects of water supply, water distribution, wastewater collection, and wastewater treatment and disposal. Knowledge and understanding of water supply and distribution to include: sources, quantity required, effect of storage on quality, storage capacity, water transmission, watershed protection, quality evaluation, stream sampling procedures, and distribution design. Knowledge and understanding of wastewater to include: physical conditions, quantity anticipated, collection system design, collection system maintenance, lift stations, biological life associated with water pollution control, and effect of liquid wastes on streams and lakes.

Instructional Methods proposed: Lecture, laboratory exercises, report preparation, problem solving.

Topic Outline:

	MAJOR DIVISIONS	Hours Class	Hours Laboratory
I.	Water Sources	2	
II.	Water Demand	2	
III.	Water Storage	2	6
IV.	Storage Effect on Water	3	6
V.	Raw Water Transmission	3	9
VI.	Watershed Protection	2	
VII.	Water Quality Evaluation	3	
VIII.	Water Distribution Design	4	12
IX.	Wastewaters	3	
X.	Wastewater Collection	4	15
XI.	Wastewater Treatment	4	6
XII.	Effect of Liquid Wastes on Streams and Lakes	3	6
	Total	36	54

I. Water Sources
   A. Units of Instruction
      1. Rain water supplies
      2. Surface water supplies
      3. Ground water supplies
   B. Laboratory Projects (none)

II. Water Demand
   A. Units of Instruction
      1. Domestic
      2. Industrial
      3. Fire demand
      4. Demand factors
   B. Laboratory Projects (none)

III. Water Storage
   A. Units of Instruction
      1. Rainfall
      2. Storage losses
      3. Rainfall-runoff relationship
      4. Mass curve
   B. Laboratory Projects
      1. Predict population growth of typical city by graphical projection showing arithmetical, geometric, and incremental increase, and the population census ratio.
      2. Determine yield of watershed by rainfall-runoff relationship.
      3. Determine raw water storage requirement for a typical supply by means of mass diagram, dryest month, and empirical data.

IV. Storage Effect on Water
   A. Units of Instruction
      1. Sedimentation
      2. Bacterial decay
      3. Organic matter decomposition
      4. Controlling factors
   B. Laboratory Projects (none)

V. Raw Water Transmission
   A. Units of Instruction
      1. Methods
      2. Proper intake design
   B. Laboratory Projects
      1. Select and detail transmission line and appurtenances for a specific flow and topographic condition.
      2. Draw and detail a raw water intake structure for a specific flow and impoundment condition.

VI. Watershed Protection
   A. Units of Instruction
      1. Wastewater Pollution
      2. Recreation
      3. Erosion
   B. Laboratory Projects (none)

VII. Water Quality Evaluation
- A. Units of Instruction
  1. Potability
  2. Chemical
  3. Physical
  4. Manufactured pollutants
  5. Natural pollutants
- B. Laboratory Projects (none)

VIII. Water Distribution Design
- A. Units of Instruction
  1. Component parts
  2. System layout
  3. Quantity considerations
  4. General rules
  5. Planning methods
  6. Elevated storage
- B. Laboratory Projects
  1. Select proper pipe size for principal distribution mains, with elevated storage located at various points in a typical city.
  2. Construct a pressure contour map of a section of a typical city.
  3. Select and detail water distribution system of a typical subdivision to comply with N.B.F.U. requirements.

IX. Wastewaters
- A. Units of Instruction
  1. Composition
  2. Quantity
- B. Laboratory Projects (none)

X. Wastewater Collection
- A. Units of Instruction
  1. Transportation
  2. Collection system design
  3. Maintenance of collection system
- B. Laboratory Projects
  1. Diagram a wastewater collection system for a subdivision, complete with profile and details.
  2. Visit a sanitary sewer construction project to observe materials, equipment, and methods used.
  3. Draw in detail a liquid waste lift station for a specific flow.

XI. Wastewater Treatment
- A. Units of Instruction
  1. Necessity of treatment
  2. Disposal without treatment
  3. Primary treatment
  4. Secondary treatment
  5. Disinfection and deodorization
- B. Laboratory Projects
  1. Visit selected installations in the locality for innovations in basic processes.

2. Prepare a report describing and comparing the main features of each installation visited.

XII. Effect of Liquid Wastes on Streams and Lakes

A. Units of Instruction
   1. Zones of pollution
   2. Methods of recovery
   3. Biological life of pollution
   4. Bottom deposits
   5. Industrial wastes

B. Laboratory Projects
   1. Observe streams above and below discharge points for visible effect of pollution.
   2. Check effluent from a wastewater lagoon for comparison with municipal waste treatment plant.

Water Purification
Course Description

(18 week course) 3 units

Prerequisite: None

Catalog Description: A study of basic principles of water purification including: aeration sedimentation, rapid sand filtration, chlorination, treatment chemicals, taste and odor control, bacteriological control, mineral control, design criteria, maintenance programs, and operational problems. New processes and recent developments are studied. Criteria, rules, regulations, forms, and records associated with the field are considered. 2 hours lecture, 3 hours laboratory.

For whom is the course intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the course: To know and understand the elementary engineering aspects of the design, operation, and maintenance of water purification plants. Specific knowledge and understanding of design parameters for all processes, materials used and their pruposes, types of miscellaneous equipment and their operation, maintenance of plant and equipment, and typical solutions to specific operational problems. A critical evaluation of the design and operation of a local plant completes the course.

Instruction Methods proposed: Lecture, Laboratory exercises, report preparation, problem solving.

Topic Outline: MAJOR DIVISIONS

	Hours	
	Class	Laboratory
I. Aeration	2	3
II. Sedimentation	4	6
III. Filtration	5	9
IV. Chlorination	3	3
V. Coagulation	5	9
VI. Bacteriological Control	3	6
VII. Softening	3	3
VIII. Clear-Well Storage	3	6
IX. Public Health Standards	2	
X. Maintenance Organization	2	3
XI. Preventative Maintenance	2	
XII. Pumps and Prime Movers	2	6
Total	36	54

I. Aeration
   A. Units of Instruction
      1. Objectives
      2. Types of aerators
      3. Theory
      4. Aerator design problems
      5. Operational problems
   B. Laboratory Projects
      1. Diagram a local installation.
      2. Calculate hydraulic head loss through a typical aerator.
      3. Determine aerator pipe sizes for a specific design flow.

II. Sedimentation
   A. Units of Instruction
      1. Theory
      2. Types of sedimentation basins
      3. Design parameters
      4. Operational problems
   B. Laboratory Projects
      1. Measure and calculate detention time of a sedimentation basin.
      2. Using dyes, determine flow time and pattern of a sedimentation basin.

III. Filtration
   A. Units of Instruction
      1. Theory
      2. Types of filtration
      3. Design parameters
      4. Operational problems
   B. Laboratory Projects
      1. Describe the design parameters of an existing rapid sand filter.
      2. Prepare a detail diagram of the construction features of a rapid sand filter.
      3. Calibrate rate controller by means of hook gage and stop watch.
      4. Calibrate loss of head gages by means of piezometer tubes.

IV. Chlorination
   A. Units of Instruction
      1. Purposes
      2. Point of application
      3. Chlorination practice
      4. Methods of application
      5. Determination of dosages
      6. Operational problems
   B. Laboratory Projects
      1. Trace the chlorine feeding system of a local installation.
      2. Prepare a cost analysis of the various chlorine compounds available.
      3. Check gravimetric feed rate against visual meter for 24-hour run.

V. Coagulation
- A. Units of Instruction
  1. General
  2. Theory of coagulation
  3. Chemical reactions
  4. Mixing and flocculation
  5. Operational problems
- B. Laboratory Projects
  1. Observe and sketch the operational principle of two types of dry chemical feed machines.
  2. Measure, calculate, and draw the mixing basin of a local plant.
  3. Measure, calculate, and draw the coagulating basin of a local plant.
  4. Design a coagulating basin for a specific flow-rate complete with agitators.

VI. Bacteriological Control
- A. Units of Instruction
  1. Chemicals used
  2. Laboratory samples
  3. Operational problems
- B. Laboratory Projects
  1. Calculate the quantity of chlorine required to sterilize a new main installation.
  2. Diagram in detail a vacuum release valve installation.

VII. Softening
- A. Units of Instruction
  1. General
  2. Substances causing hardness
  3. Lime-soda process
  4. Zeolite process
  5. Operational problems
- B. Laboratory Projects (none)

VIII. Clear-Well Storage
- A. Units of Instruction
  1. Function
  2. Types
  3. Quantity requirements
  4. Operational problems
- B. Laboratory Projects
  1. Observe several types of clear-well storage reservoirs.
  2. Calculate the hydraulic head loss in clear-well storage.

IX. Public Health Standards
- A. Units of Instruction
  1. Terminology
  2. Bacterial quality
  3. Physical limits
  4. Chemical limits

X. Maintenance Organization
   A. Units of Instruction
      1. Functions
      2. Essentials of program
      3. Work execution
      4. Training
      5. Preventive maintenance
      6. Maintenance improvement
      7. Corrective maintenance
      8. Cost control
   B. Laboratory Projects
      1. Observe the maintenance organizations of the local water treatment plant as to work orders, follow-up, and records.
      2. Study the cost control for maintenance in a water treatment plant.

XI. Preventive Maintenance
   A. Methods of Instruction
      1. Corrosion
      2. Protective coating
      3. Lubrication
   B. Laboratory Projects (none)

XII. Pumps and Prime Movers
   A. Units of Instruction
      1. Principle causes of pump malfunction
      2. Indications of Trouble
      3. Routine maintenance of pumps
      4. Routine maintenance of motors
   B. Laboratory Projects
      1. Disassemble a centrifugal pump--identifying all parts.
      2. Measure wearing rings to determine clearance.
      3. Renew packing and check priming procedure.

Wastewater Treatment
Course Description

(18 week course) 4 units

Prerequisite: Water Supply and Wastewater Control

Catalog Description: This course is designed to familiarize the student with the elementary engineering aspects of design, operation process control, and maintenance of wastewater treatment plants and facilities. 3 hours lecture, 3 hours laboratory.

For whom the course is intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the course: To know and understand design parameters for all processes, materials used and their purposes, type and operation of miscellaneous equipment, maintenance of plant and equipment, and typical solutions to specific operational problems. Specific knowledge and understanding of wastewater treatment, hydraulic layout of treatment plant, selection of treatment method, industrial wastewater treatment, maintenance programs, health regulations, and pertinent reports. A critical evaluation of local wastewater treatment plant will be included.

Instructional Methods proposed: Lecture, Laboratory exercises, report preparation, problem solving.

Topic Outline:

	MAJOR DIVISIONS	Hours Class	Hours Laboratory
I.	Methods of Treatment	6	9
II.	Treatment Selection	6	12
III.	The Treatment Plant	14	12
IV.	Industrial Wastewaters	12	6
V.	Rules, Regulations, and Forms	4	3
VI.	Preventative Maintenance	4	6
VII.	Sewer Cleaning	4	3
VIII.	Safety	4	3
	Total	54	54

I. Methods of Treatment
- A. Units of Instruction
  1. Review of basic treatment processes
  2. Innovations in processes
- B. Laboratory Projects
  1. Prepare flow diagrams for several types of treatment processes that can be found in the locality.
  2. Prepare reports on various manufacturer's proprietary treating devices, indicating the process and expected efficiency.

II. Treatment Selection
    A. Units of Instruction
        1. Objectives of treatment
        2. Use of septic tank and nitrification field
        3. Use of septic tank and sand filter
        4. Anaerobic lagoons
        5. Aerobic lagoons
        6. Extended aeration
        7. Complete municipal system
    B. Laboratory Projects
        1. Make a diagram of a septic tank showing details of the entire system. Write a report describing the function of the system; its advantages and limitations in detail.
        2. Write a report describing either an anaerobic or an aerobic lagoon. Diagram the system and present a detailed analysis of its operation and limitations.
        3. Make a field trip to a municipal wastewater treatment plant. Make a diagram of the complete system, and write a report describing its operation in detail.

III. The Treatment Plant
    A. Units of Instruction
        1. Physical facilities
        2. Hydraulic layout of plant
        3. Laboratory efficiency check
    B. Laboratory Projects
        1. Calculate the hydraulic head loss in a local plant.
        2. Determine pump size and horsepower for recirculation pump in a local plant.
        3. Study a standardized check-list used at a specific plant in the locality.
        4. Assign specific operation and problems for students to solve by investigation of the local municipal waste treatment plant.

IV. Industrial Wastewaters
    A. Units of Instruction
        1. Nature of wastes
        2. Waste effects
        3. Characteristics and methods of treatment
    B. Laboratory Projects
        1. Plan a treatment process for specific industrial wastes and flow based on latest literature.
        2. Observe and identify the principles and methods used in an industrial wastewater treatment process in a local plant.

V. Rules, Regulations and Forms
    A. Units of Instruction
        1. Purposes
        2. Types of records
        3. Monthly forms required by the Water Pollution Control Agency
        4. Contents of annual report to governing board
    B. Laboratory Projects
        1. Review the operating records of the local wastewater treatment plant for information on efficiency, costs, and operational problems.
        2. Prepare a sample monthly report, using data from the operating records reviewed in item #1.

VI. Preventive Maintenance
- A. Units of Instruction
  1. Purposes
  2. Lubrication
  3. Protective coatings
  4. Electrical equipment
  5. Plant structure
  6. Plant equipment
- B. Laboratory Projects
  1. Disassemble a piston type pump and identify all parts.
  2. Investigate types and effectiveness of protective coatings used in a local wastewater treatment plant.

VII. Sewer Cleaning
- A. Units of Instruction
  1. Work involved
  2. Causes of trouble
  3. Necessary equipment
- B. Laboratory Projects
  1. Visit location of a sewer-cleaning operation to familiarize the students with hand and mechanical augers.
  2. Compare cost of using hand and mechanical augers.

VIII. Safety
- A. Units of Instruction
  1. Occupational hazards in wastewater works
  2. Accident prevention
  3. Safety program
- B. Laboratory Projects (none)

Instrumentation and Controls
Course Description

(18 week course) 3 units

Prerequisite: None

Catalog Description: An elementary study of hydraulic, pneumatic, mechanical, electrical and electronic contol systems and components. It includes a basic description, and explanation of operation of instrumental controls for water and wastewater plants. Typical performance characteristics, accuracy, and applications of instruments are studied. 2 hours lecture, 3 hours laboratory.

For whom the course is intended: Pre-employment and upgrading of those currently employed in the field.

Objectives of the course: To know and understand the application, maintenance, and calibration of specific instruments essential to water purification and wastewater treatment systems. Study of typical performance characteristics, limitations, accuracy, and utilization of specific instruments in the various industrial processes is included.

Instructional Methods proposed: Lecture, Laboratory exercises, report preparation, problem solving.

Topic Outline:

	MAJOR DIVISIONS	Hours Class	Hours Laboratory
I.	Pressure	3	6
II.	Recorders	3	6
III.	Flow	6	6
IV.	Liquid Level	3	3
V.	Temperature	2	3
VI.	Humidity	2	3
VII.	Control	3	6
VIII.	Control Valves	2	3
IX.	Transmitters	3	3
X.	Blind Controllers	2	3
XI.	Miniature Recorders	3	6
XII.	Graphic Panels	3	6
	Total	36	54

I. Pressure
- A. Units of Instruction
  1. Nature of pressure
  2. Manometers
  3. Gage calibration
  4. Bourdon tube gages
  5. Diaphragm pressure element
  6. Vacuum and compound gages
  7. Electrical pressure measurements

B. Laboratory Projects
   1. Compare and calibrate the following pressure gages against known standards; then, make a series of pressure measurements.
      a. Manometer
      b. Bellows
      c. Bell gage
      d. Bourdon tube
   2. Demonstrate the use of resistance-change strain gages for a series of comparative pressure tests.
   3. Demonstrate the use of the Pirani thermocouple vacuum for a series of comparative pressure tests.

II. Recorders
   A. Units of Instruction
      1. Components
      2. Adjustments
   B. Laboratory Projects
      1. Study components of recorders and calibrate, utilizing pneumatic pressure and electrical signal for transmission of signal from primary device.
      2. Change a chart and adjust the writing pen on a recorder.

III. Flow
   A. Units of Instruction
      1. Primary elements
      2. Secondary elements
      3. Installation of flow meters
      4. Flow calibration
      5. Electrical flow measurements
   B. Laboratory Projects
      1. Compare the flow ratio of venturi meters, orifice plates, and various weir plates over a wide range of flow against a calibrated tank.
      2. Determine discharge coefficient of venturi meters, orifice plates, and various weir plates over a wide range of flow rates.

IV. Liquid Level
   A. Units of Instruction
      1. Primary elements
      2. Secondary elements
      3. Application
      4. Electrical liquid-level measurement
   B. Laboratory Projects
      1. Plot pressure as a function of depth by means of a diaphragm box.
      2. Plot pressure as a function of depth by means of back-pressure bubbler system.
      3. Compare the liquid pressure observed by mechanical means with the capacitance level gage.

V. Temperature
   A. Units of Instruction
      1. Scales
      2. Types of thermal units
      3. Installation
      4. Electrical temperature measurement

B. Laboratory Projects
   1. Measure the temperature of different fluids with gas-filled and liquid-filled thermometers.
   2. Demonstrate the use of several types of thermocouples by using them to make temperature measurements.

VI. Humidity
   A. Units of Instruction
      1. Absolute humidity
      2. Relative humidity measurement
      3. Dew point
   B. Laboratory Projects
      1. Determine the relative humidity of the classroom by use of the dry- and wet-bulb hygrometer, and compare humidity measurement with that determined by the resistance-type hygrometer.
      2. Demonstrate dew point by cooling the warm moist air in a bell jar.

VII. Control
   A. Units of Instruction
      1. Process control
      2. On-off control
      3. Proportional control
      4. Full controllers
      5. Special control elements
      6. Controller auxiliaries
      7. Adjustment
   B. Laboratory Projects
      1. Determine rate of response of a pneumatic system when violently upset.
      2. Determine the rate of response of an electrical system and compare with that of a pneumatic system.

VIII. Control Valves
   A. Units of Instruction
      1. Manual
      2. Air valves
      3. Valve positioners
   B. Laboratory Projects
      1. Determine flow through selected electric and pneumatic control valves at various positions by means of a standard volume tank.
      2. Calibrate a piston-type valve positioner.

IX. Transmitters
   A. Units of Instruction
      1. Functions
      2. Operation
      3. Adjustments
   B. Laboratory Projects
      1. Calibrate a pneumatic transmitter over the full range of operation.
      2. Demonstrate the operation of a differential pressure transmitter.

X. Blind Controllers
    A. Units of Instruction
        1. Functions
        2. Advantages
    B. Laboratory Projects
        1. Make a volumetric check on a blind-control installation.
        2. Demonstrate the function of a blind controller.

XI. Miniature Recorders
    A. Units of Instruction
        1. Advantages
        2. Operation
    B. Laboratory Projects
        1. Perform routine maintenance check and calibration of a miniature recorder.
        2. Demonstrate advantages of dual recordings.

XII. Graphic Panels
    A. Units of Instruction
        1. Purposes
        2. Advantages
    B. Laboratory Projects
        1. Detail a graphic panel to show the flow of liquid through a wastewater treatment plant.
        2. Detail a graphic panel to show the flow of water through a rapid-sand filter.

This curriculum is patterned after the curriculum set forth in Curriculum Guide for Occupational Safety and Health Technicians by Gilbert Rhodes & Associates, 1972. If implementation of this curriculum is undertaken, it is recommended that the book be used in its entirety with references, costs of program and course outlines. This adaptation was approved by the following advisory committee:

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OCCUPATIONAL SAFETY AND HEALTH TECHNICIAN

SUGGESTED TWO-YEAR PROGRAM

Freshman

First Semester

	COURSE	UNITS
OSH 110	INTRO TO OCCUPATIONAL SAFETY AND HEALTH	3
OSH 115	SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS	3
	Supporting Science, Math, General Education, P.E., Electives	10
		16

Second Semester

OSH 120	PHYSICAL HAZARDS CONTROL I	3
OSH 125	ELEMENTS OF INDUSTRIAL HYGIENE	3
	Supporting Science, Math, General Education, P.E., Electives	10
		16

Sophomore

First Semester

OSH 210	PHYSICAL HAZARDS CONTROL II	3
OSH 215	TECHNIQUES OF INDUSTRIAL HYGIENE	3
	Supporting Science, Math, General Education, P.E., Electives	6
	Work Experience	4
		16

Second Semester

OSH 220	HUMAN FACTORS IN SAFETY	3
OSH 225	SAFETY PROGRAM MANAGEMENT	3
	Supporting Science, Math, General Education, P.E., Electives	6
	Work Experience	4
		16

RECOMMENDED ELECTIVE:

OSH 230	INDUSTRIAL FIRE PROTECTION	3

COURSE OUTLINE

OSH 115

SAFETY & HEALTH STANDARDS, CODES & REGULATIONS

CATALOGUE DESCRIPTION A review of the important occupational safety and health standards and codes with particular emphasis on application of these codes to typical work situations.

COURSE OBJECTIVES To develop understanding of the importance and scope of occupational safety and health codes; to develop ability to interpret the codes in terms of practical application.

TOPIC OUTLINE

1. HISTORY OF CODES AND STANDARDS - From the beginning of recorded history, man has had a relationship with others that appears to have required safety and health laws. Chronologically this history will be reviewed.

2. CALIFORNIA LABOR CODE - A review of the State agencies operating in the safety and health field and their enabling legislation including the role of the California Inspection Rating Bureau.

3. THE CALIFORNIA HEALTH AND SAFETY CODE - A review of the public codes, ie., sanitation, air, water, pest control. The state Fire Marshall's responsibilities and the Building Standards and Earthquake Protection.

4. CALIFORNIA VEHICLE CODE - A review of vehicle accidents and reports, equipment and loads, hazardous cargo. Included will be Safety Orders of the Public Utilities Commission.

5. DIVISION OF INDUSTRIAL SAFETY ORDERS - A review of pressure vessels and the Construction Safety Orders.

6. DIVISION OF INDUSTRIAL SAFETY ORDERS - A review of the General Industry Safety Orders i.e., general plant equipment, power transmission equipment, prime movers, machines and machine parts.

7. DIVISION OF INDUSTRIAL SAFETY ORDERS - General Industrial Safety Orders continued. Review of point of operation, cranes, gas systems for welding and cutting, control of hazardous substances and the highlights of specialized safety orders.

8. FEDERAL REGULATORY BODIES AND THEIR OCCUPATIONAL INFLUENCE - Describing the responsibilities in safety and health by various Federal Departments and Agencies i.e., Department of Labor, Department of Health, Education and Welfare, Deaprtment of Transportation.

9. FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 - Explanation of the Law and how it works, penalties and how violations are processed. Judicial review of orders, relation to State Law.

10. OCCUPATIONAL SAFETY AND HEALTH STANDARDS - FEDERAL - Review of building and Construction, Mining, Federal Service Contracts Act,

Walsh Healy Public Contracts Act.

11. OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for walking and working surfaces, means of egress and powered platforms, manlifts and vehicle mounted platforms.

12. OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for occupational health, environmental controls, hazardous materials, personal protective equipment and medical and first aid.

13. OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for compressed gases and equipment, materials handling and storage, powered industrial trucks, cranes and derricks.

14. OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for machines and machine guarding, hand and portable powered tools and special industries.

15. OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of the electrical standards including overcurrent protection, grounding, cords, cables, transformers, appliances and hazardous locations.

16. ADVISORY OR CONSENSUS STANDARDS - A review of other standards and codes promulgated by organizations like the National Fire Protection Association, American National Standards Institute, Uniform Building Code, Underwriters Laboratory and Factory Mutual Engineering Corporation.

17. FIELD EXERCISE - A plant visit to inspect for violations of safety and health standards, codes and regulations.

COURSE OUTLINE

OSH 120

PHYSICAL HAZARDS CONTROL I

CATALOGUE DESCRIPTION An examination of physical hazards in the work environment and methods of control.

COURSE OBJECTIVES To explain and illustrate methods of control of hazards with particular reference to regulatory standards. To develop ability to recognize and recommend corrective measures for most common hazards found in industry.

TOPIC OUTLINE

1. FUNDAMENTALS OF SYSTEMS SAFETY - Definition of system safety terms. A review of the "factory" as a system and the significant "system" interfaces.

2. FUNDAMENTALS OF HUMAN FACTORS ENGINEERING - A review of the capabilities and limitations of man, man machine relationships and the design requirements necessary to fit man.

3. DESIGN AND LAYOUT - The significant considerations in site and facility planning are developed including transportation facilities, traffic control, waste disposal and lighting.

4. PLANNING CONSIDERATIONS - A study of the significant aspects of exits, floors, walkways, storage facilities, process flow and equipment layout in planning.

5. PLANNING CONSIDERATIONS - A continuation of planning considerations including floor loading, color & safety and principles of material handling.

6. PRINCIPLES OF GUARDING - A study of the types of mechanical motion and the basic types of mechanical hazards.

7. DESIGN AND CONSTRUCTION OF GUARDS - A review of Federal and State standards and their application to guard design. Design principles are developed in relation to the basic machine mechanisms.

8. MACHINE GUARDING APPLICATIONS - A practical study of specific machine problems covering machine tools, woodworking machines and power transmission equipment.

9. ELECTRICAL SAFETY - PRINCIPLES - A review of elementary electricity emphasizing its effects on man and the selection and installation of electrical equipment.

10. ELECTRICAL SAFETY - EMPLOYEE TRAINING AND SAFETY PROCEDURES - The role and value of employee training and development of safety procedures. Emergency procedures, lockout systems and grounding protection is emphasized.

11. MANUAL MATERIALS HANDLING - An examination of manual lifting techniques,

accessories used in lifting and safe storage techniques.

12. WAREHOUSING AND MATERIALS HANDLING EQUIPMENT - A review of warehouse arrangement. traffic flow, lift truck operation and fire considerations. General types of hoisting apparatus are examined.

13. RIGGING EQUIPMENT AND PROCEDURES - A study of wire rope construction and use. Rigging methods and accessories are examined.

14. CONVEYORS AND ELEVATORS - Types of equipment and guarding techniques are studies. The principles of elevator operation, maintenance and inspection are examined.

15. WELDING AND CUTTING OPERATIONS - The hazards and use of oxygen, acetylene and hydrogen are studied. The principles of regulators and welding equipment are reviewed.

16. RESISTANCE WELDING - The principle and safety considerations of resistance and arc welding are examined.

17. GENERAL SAFETY CONSIDERATIONS - Miscellaneous hazards of welding are studied including ultra violet light, fire potential and working on closed containers. The role of protective clothing is reviewed.

COURSE OUTLINE

OSH 125

ELEMENTS OF INDUSTRIAL HYGIENE

CATALOGUE DESCRIPTION A basic introduction to the field of Industrial Hygiene. A survey of the effects of toxic agents on the body and general methods of control.

COURSE OBJECTIVES To develop understanding of broad concepts of Industrial Hygiene and to develop ability to recognize potentially hazardous environmental conditions.

TOPIC OUTLINE

1. HISTORY, RESPONSE TO TOXIC MATERIAL - The history of man's exposure to toxic materials from the ancients to the OSH Act of 1970. A review of the acute and chronic response of the body to toxic material.

2. ROUTES OF ENTRY INTO BODY - LUNGS - An anatomical review of the lungs. The relation of breathing rate, lung capacity, particle size and retention to toxic inhalants is studied.

3. ROUTES OF ENTRY INTO BODY - SKIN - An anatomical review of the skin covering the epidermis, dermis and subcutaneous tissue. Dermatitis and its cause is studied in depth.

4. ROUTES OF ENTRY INTO BODY - INGESTION - An anatomical review of the digestive tract with emphasis on the resultant damage on the liver and kidney. The specific effects of selected materials are studied.

5. THRESHOLD LIMIT VALUES - The concept of threshold values is studied emphasizing the source of values, use and misuse and units of expression. Record-keeping is emphasized.

6. TOXIC AGENTS - SOLVENTS, GASES AND VAPORS - The effects of these materials is studied. Routes of entry - inhalation, ingestion, and skin absorption are reviewed. The effect of inert gases and oxygen deficiency are studied

7. TOXIC AGENTS - DUSTS, MISTS - An examination of the effects on man. The relation of particle size to and effect on the body is studied.

8. TOXIC AGENTS - DUSTS, FUMES, SMOKE - An examination of the effects on man.

9. IONIZING RADIATION - An examination of ionizing radiation and its effects on man.

10. NON-IONIZING RADIATION - Light, ultra violet, infra red, lasers and radio frequency are studied emphasizing unit of measurement, effects on man and exposure standards.

11. TEMPERATURE, PRESSURE, NOISE AND VIBRATION - Temperature and pressure measurement and effects on man are studied. Anatomy of the ear, hearing physiology and units of noise measurement are studied.

12. NOISE - The exposure standards, measurement and control techniques are studied.

13. CONTROL MEASURES - VENTILATION - Exhaust ventilation is studied emphasizing laminar and turbulent flow and capture velocity concepts. Typical ventilation problems are examined.

14. CONTROL MEASURES - ISOLATION, SUBSTITUTION, LABELING - Isolation, substitution and labeling are studied as control techniques. Practical case problems are studied.

15. CONTROL MEASURES - PROTECTIVE EQUIPMENT - Protective clothing as related to toxic materials is reviewed. The role and use of respirators is studied in depth.

16. SANITATION IN THE WORK PLACE - The potential effects on man of water supply, liquid waste, solid waste, insect and rodent control and food handling is examined.

17. ENVIRONMENTAL CONCERNS - Federal policies on air and water pollution are examined. The resources of local, state and federal agencies are reviewed.

COURSE OUTLINE

OSH 210

PHYSICAL HAZARDS CONTROL II

CATALOGUE DESCRIPTION Continuation of Physical Hazards Control I. An examination of the control of physical hazards in the work environment

COURSE OBJECTIVES Same as for Physical Hazards Control I.

TOPIC OUTLINE

1. HAND AND PORTABLE POWER TOOLS - A review of injury statistics and the control of accidents from this source. An examination of the maintenance, repair and use of specific tools.

2. POWER TOOLS - The techniques of inspection, repair, guarding and use. A general review of the operation of specific tools including pneumatic and power activated tools.

3. PERSONAL PROTECTIVE EQUIPMENT - HEAD, EAR, EYE - An examination of the role of personal protective equipment in injury prevention emphasizing standard and specific equipment for head, ear and eye protection.

4. PERSONAL PROTECTIVE EQUIPMENT - FOOTWEAR, RESPIRATORY - A continuation of the examination of personal protective equipment emphasizing footwear and respiratory protection.

5. SAFETY BELTS AND PROTECTIVE CLOTHING - Conclusion of the examination of personal protective equipment covering clothing for protection from heat, electrical protection, and the inspection, testing and maintenance of safety belts and lifelines.

6. CHEMICAL HAZARDS - INJURY CAUSES, RESPONSIBILITY - A review of the causes of chemical accidents. The role of labeling, waste disposal and transportation in chemical accidents is discussed.

7. CHEMICAL HAZARDS - CONTROL METHODS - A review of typical hazardous chemical reactions and their control is presented. Protective equipment and biological hazards are studied.

8. HIGH PRESSURE SAFETY - A review of the physical properties of gases as related to accidents. Safe testing and installation of gauges, lines and equipment are studied.

9. COMPRESSED GAS CYLINDERS - GENERAL - A review of cylinder handling and storage. The use of manifolds, regulators and color coding for safe usage.

10. COMPRESSED GAS SYSTEMS - OPERATION AND MAINTENANCE - A review of the proper design, assembly operations, and maintenance of pressure systems.

11. ILLUMINATION - The role of lighting and safety are studied. Measurements, standards, quality, quantity, light sources are covered. The proper conduct of lighting surveys is reviewed.

12. SLIPS, TRIPS AND FALLS - Slips, trips and falls as accident sources are studied. The construction consideration of floors, ladders and scaffolds are reviewed.

13. WORKING AT ELEVATIONS - A review of the inspection, testing and safety rules for ladders and scaffolds. The types and specifications for scaffolds.

14. INSPECTION TECHNIQUES - Inspections as control techniques are studied emphasizing types of inspections and inspection techniques.

15. SAFETY OBSERVER PLAN - The use of the observer program and safety sampling as accident control techniques is studied.

16. ACCIDENT INVESTIGATION - The techniques of accident investigation are developed emphasizing cause determination, system failure, and fact collection. Case study techniques are used.

17. ACCIDENT ANALYSIS - The analysis of investigation data considering automatic data processing systems, cost analysis and information utilization.

COURSE OUTLINE

OSH 215

TECHNIQUES OF INDUSTRIAL HYGIENE

CATALOGUE DESCRIPTION Exploration of basic categories of field instruments for detection of toxic substances with explanation of underlying theoretical principles.

COURSE OBJECTIVE To develop ability to select and use appropriate field equipment for monitoring toxic equipment under professional guidance.

TOPIC OUTLINE

1. AIR CONTAMINANTS - GAS AND VAPORS - PARTICULATES - A review of the definition of terms and the collection properties of materials.

2. SAMPLING CONSIDERATIONS - The concepts of representative sampling and sampling efficiency are studied. The effect of the nature of contaminant on sampling is examined.

3. CALIBRATION OF INSTRUMENTS - Specific calibration techniques are examined for: air flow metering devices, grab samplers, concentrating instruments and direct reading instruments.

4. CALIBRATION OF INSTRUMENTS (LABORATORY) - Volume calibration using a wet gas meter and flow rate calibrator using a manometer.

5. AIR SAMPLERS - A review of the following instruments: hand pump, piston pump, ejector, fans, vane pumps, diaphragm pump.

6. INERTIAL COLLECTORS - The theoretical principles are studied. The operation of impingers and cyclone collectors are studied in detail. Basic concepts of dust counting are covered.

7. AIR SAMPLERS, INERTIAL COLLECTORS (LABORATORY) - Samples are collected using impingers. Dust samples are counted.

8. DIRECT READING COLORIMETRIC INDICATORS - The theory and use of liquid reagents, chemically treated papers and indicating tubes is studied. The collection of samples for future laboratory analysis is covered.

9. DIRECT READING INDICATOR TUBES - The use and limitations of indicator tubes is examined.

10. DIRECT READING COLORIMETRIC INDICATORS AND INDICATOR TUBES (LABORATORY) - Air pump calibration is conducted. A variety of colorimetric indicators and indicator tubes are used on unknown materials.

11. DIRECT READING PHYSICAL INSTRUMENTATION - The theory of operation is studied. The general consideration of use - calibration, interferences, sensitivity and specificity is covered.

12. DIRECT READING PHYSICAL INSTRUMENTATION (LABORATORY) - The measurement of unknown concentrations of ozone, oxygen and combustible gas using the appropriate instrument.

13. DIRECT READING PHYSICAL INSTRUMENTATION (LABORATORY) - The measurement of unknown concentrations of carbon monoxide, mercury, halides and hydrocarbon using the appropriate instruments.

14. VENTILATION SURVEY INSTRUMENTATION - A study of the principles of instrumentation in ventilation.

15. VENTILATION SURVEY INSTRUMENTATION (LABORATORY) - The use of vane anemometer, thermo anemometer, velometers and smoke tubes in evaluating ventilation systems.

16. NOISE EVALUATION - The study of the proper techniques used in noise survey instrumentation.

17. NOISE EVALUATION (LABORATORY) - Practical noise surveys are accomplished.

COURSE OUTLINE

OSH 220

HUMAN FACTORS IN SAFETY

CATALOGUE DESCRIPTION Designed to acquaint the student with the physiological and psychological factors that contribute to accident causation, an exploration of theoretical and research findings.

COURSE OBJECTIVES To develop understanding of and appreciation for human factors in machine and environmental design and those factors as they influence accident causation.

TOPIC OUTLINE

1. THEORIES OF ACCIDENT CAUSATION - A brief survey of significant and contemporary research, with overview of major theories and their application to accident prevention.

2. LIFE SCIENCES AND SAFETY - A review of the contributing disciplines, research methods and techniques and major contributions.

3. THE WHOLE MAN AT WORK - A view of the capabilities and limitations of man, of man as a thinking, feeling subsystem in a man-machine system.

4. PSYCHOLOGY AND SAFETY - Psychology's contributions to safety, training, testing, indoctrination, understanding attitudes.

5. MOTIVATING EMPLOYEES FOR SAFETY - A review of contemporary theories of motivation and organizational behavior, their application to safety programming.

6. COMMUNICATIONS - An examination of the barriers to effective communications and of effective safety programs.

7. PHYSIOLOGY - An examination of the skeletal, muscle and respiratory systems with particular reference to environmental and work stresses.

8. PHYSIOLOGY (continued) - A look at the circulatory system, nervous systems and sense organs as determiners of the capabilities and limitations of man.

9. ENVIRONMENTAL STRESSES AND BODY RESPONSES - The effects of temperature, pressure, noise, fatigue and psychological stresses.

10. CHEMICAL EXPOSURES - A review of the concepts of toxicity, the modes of physiological attack and the normal control methods.

11. DESIGN FOR HUMAN FACTORS - Advantages and disadvantages of man vs. machine and typical concerns of man in relation to machine.

12. MAN AS A SUB-SYSTEM - A look at the man-machine systems and the design of equipment for man as a sub-system.

13. INDIVIDUAL DIFFERENCES - A look at the wide variation in human capabilities and the design requirements to cope with the variations.

14. HUMAN FACTORS AND PLANT DESIGN - A look at personal injuries and machine design with particular reference to human behavior patterns.

15. PLANT LAYOUT - Designing for human factors at the planning stage using OSHA and ANSI standards as guidelines.

16. SUPERVISION AND SAFETY - The supervisor's responsibilities and leadership as a trainer, as the man on the scene and discussion of tools to help the supervisor with his people.

17. HUMAN FACTORS IN PERSPECTIVE - An overview of the "people" problem and the means of coping with it.

COURSE OUTLINE

OSH 225

SAFETY PROGRAM MANAGEMENT

CATALOGUE DESCRIPTION Designed to acquaint the student with the common elements of a safety program.

COURSE OBJECTIVES To examine and define the structure of a typical industrial concern and the safety organization and its planning and budgeting process. To develop ability to plan and organize a program suitable for a typical facility.

TOPIC OUTLINE

1. THE MODERN ORGANIZATION - An examination of the modern organization including the formal and informal organization, line and staff responsibilities, responsibilities of individual safety and health personnel. This is integrated into a general review of management principle.

2. SAFETY AND LOSS CONTROL ORGANIZATION - MANAGEMENT - RESPONSIBILITIES - A review of management responsibilities as related to the establishment of policies, allocation of resources, implementation of programs and the enforcement of policies.

3. SAFETY AND LOSS CONTROL ORGANIZATION - SPECIALIZED STAFF - A study of the role of the specialized safety staff including its position in the organization, relationship to supervisors, and authority.

4. SAFETY AND LOSS CONTROL ORGANIZATION - ROLE OF COMMITTEES: POLICIES, ANALYSIS OF LOSS POTENTIAL - A study of the establishment and utilization of committees; the documentation of safety policy through manuals and handbooks; the techniques for analyzing the loss potential problem.

5. SAFETY AND LOSS CONTROL ORGANIZATION - PART-TIME FUNCTION, MEDICAL RESP. - An examination of methods of conducting a safety program or a part-time function with other duties. The role of insurance companies and medical supervision is covered.

6. ELEMENTS OF A SAFETY PROGRAM - SAFETY PLANNING & BUDGETING - A review of the elements of program planning forecasting and the techniques of budgeting including the budget cycle, FTE concept and recharging.

7. ELEMENTS OF A SAFETY PROGRAM - CORRECTIVE PLAN, PRIORITIES - A study of the methods of developing a corrective plan based on adequate information gathering and interpretation. The methods of determining priorities is reviewed.

8. ELEMENTS OF A SAFETY PROGRAM - MANAGEMENT DECISION & ACTION - An examination of the techniques of advising management on decision and action including the concepts of cost vs. risk, humanitarian concern and legal requirements.

9. ELEMENTS OF A SAFETY PROGRAM - IMPLEMENTING PLAN - INSPECTION - The techniques of effectively implementing the safety plan are covered. The objective of safety inspections is examined covering standards, reports, techniques, and recommendations.

10. ELEMENTS OF A SAFETY PROGRAM - COMMUNICATION, TRAINING - The techniques of safety communications are studied including media, programs, contests and family involvement. The role and techniques of safety training are reviewed.

11. ELEMENTS OF A SAFETY PROGRAM - PHYSICAL PLANT MAINTENANCE & ACCIDENT INVESTIGATION - A review of the role of maintenance in plant safety. Accident investigation techniques are studied through the use of case studies.

12. ELEMENTS OF A SAFETY PROGRAM - MOTIVATION, REPORTS & STATISTICS - The techniques of safety motivation are studied considering employee needs, personalizing safety and award programs. Injury reporting systems are presented considering supervisory and employee responsibilities.

13. ELEMENTS OF A SAFETY PROGRAM - REPORTS & STATISTICS - Methods of reporting injury statistics are studied. Frequency and severity rates are calculated and OSH Act reporting requirements studied.

14. RISK MANAGEMENT - NATURE OF RISK, RISK ASSUMPTION - Nature of risk is examined including financial, production, and physical damage. The concept of risk assumption is reviewed.

15. RISK MANAGEMENT - RISK STATISTICS - The basic statistics of risk are presented including random events, probability and distribution. Produce safety considerations are reviewed.

16. RISK MANAGEMENT - RISK TRANSFER, RISK REDUCTION - The concept of risk transfer is reviewed considering costs and the role of insurance. Risk reduction techniques are studied.

17. RESOURCES FOR THE SAFETY & HEALTH TECHNICIAN - ETHICS - Professional societies, insurance carriers, vendors, voluntary organizations, governmental agencies are reviewed as safety resources. Ethics, professional responsibility and liability are covered.

COURSE OUTLINE

OSH 230

INDUSTRIAL FIRE PROTECTION

CATALOGUE DESCRIPTION A survey course covering fire cause, building construction, flammable materials, private fire protection and codes and law.

COURSE OBJECTIVES Understanding of the principle causes of fires, and the scope of the problem. Knowledge of the operation and maintenance of fire fighting devices and systems, building materials, flammable solids, liquids, and gases and of laws and regulations. Ability to maintain and operate fire detection and fire fighting equipment and systems.

TOPIC OUTLINE

1. INTRODUCTION - In this session the purpose of the course is given, the magnitude of the fire problem is indicated and general comments about building construction, occupancy and fire fighting by both industrial and public fire departments are made.

2. THE FIRE PROBLEM - The chemistry and physics of fires and explosions are discussed with emphasis on the time-temperature curve. In greater detail, principal causes of fires and fires by occupancy are reviewed.

3. BUILDING CONSTRUCTION - Principal types of building materials and assemblies are studied and leading types of interior finishes are analyzed.

4. PROTECTING STRUCTURES FROM FIRES - This subject is reviewed in regard to restrictions on height and area, protection of vertical and horizontal openings and protection from exposure. Fire loading principles are discussed.

5. BUILDING EQUIPMENT AND FACILITIES - Protection of heat producing equipment, air conditioning and ventilating systems, electric light and power systems and blower and exhaust devices are reviewed. Life safety design is discussed.

6. FLAMMABLE LIQUIDS AND GASES - The properties, identification, storage and dispensing of frequently used flammable liquids and gases are reviewed. The proper safeguarding and operation of ovens, driers and furnaces is analyzed.

7. FLAMMABLE SOLIDS - Properties and protection of such flammable solids as explosive dusts, combustible fibers, explosives, resins, plastics, oxidizing materials and radio active materials are reviewed.

8. PROCESS HAZARDS - Operational hazards, principally finishing, welding, cutting, warehouse storage, computers and the use of industrial trucks are reviewed with emphasis on good inspection procedures.

9. LOSSES CAUSED BY NATURAL DISASTERS - Discussion of property losses resulting from windstorms, earthquakes, floods and actions that can be taken to eliminate or reduce the extent of such losses.

10. FIRE STANDARDS - National Fire Protection Association codes, standards and recommended practices are reviewed and discussed.

11. FIRE LAWS - Municipal and county regulations, State laws and Federal laws are reviewed. Emphasis is placed on the Federal Occupational Safety and Health Act of 1970.

12. PRIVATE FIRE PROTECTION - Principle aspects of private fire protection including mains and hydrants, gravity, suction and pressure tanks, fire pumps, and stand pipe and hose are reviewed. Waterflow hydraulics is covered.

13. DETECTION AND EXTINGUISHING SYSTEMS - The installation and operation of fire detection systems, automatic sprinkler systems and special systems such as foam, CO_2, water spray, and dry chemicals are studied.

14. DETECTION AND EXTINGUISHING SYSTEMS (LABORATORY) - By means of a visit to an industrial or commercial establishment or through an appropriate laboratory demonstration fire detection and extinguishing system configurations or principles are outlined.

15. FIRE FIGHTING AND OTHER EMERGENCIES - The organization of personnel for proper response to fires and other emergencies is reviewed. Proper reporting procedures, operation of hand fire extinguishers and functions of emergency organizations are covered.

16. FIRE FIGHTING (LABORATORY) - By means of a visit to an appropriate fire department training location or by suitable laboratory demonstration the operation of various types of hand fire extinguishers and fire hose is shown.

17. CONCLUSION - A summary is made of principle concepts including building construction and occupancy, codes and laws, and fire fighting devices and activities. Their interrelationship using a systems approach is discussed.

ADVISORY COMMITTEE

AIR POLLUTION TECHNICIAN

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AIR POLLUTION TECHNICIAN CURRICULM

Purpose of the Curriculm: Courses offered in this curriculm are designed to prepare students for entry level employment in the fields of air pollution control at the technical level.

Course Structure and Organization: Twenty-seven units of specialized courses appropriately balanced between lecture and laboratory. These courses are supported by required courses such as work experience , air chemistry, technical report writing, graphics and technical mathematics. These and other recommended courses will facilitate completion of the general education requirement leading to an A.A. degree upon completion of 60 units.

Requirements in the major area consists of the following courses:

I.	Introduction to Air Pollution Control	3 units
II.	Air Pollution Meteorology	3 units
III.	Atmospheric Sampling	3 units
IV.	Source Sampling	3 units
V.	Analysis of Atmospheric Inorganics	3 units
VI.	Analysis of Atmospheric Organics	3 units
VII.	Air Pollution Microscopy	3 units
VIII.	Statistical Date Evaluation	3 units
IX.	Control of Gaseous and Articulate Emissions	3 units
	TOTAL	27 units

AIR POLLOTION TECHNICIAN

Course Outline

Topic Outline:

I. Introduction to Air Pollution Control — 3 units

A. Lecture

1. Sources of pollutants
2. Effects of pollutants
3. Air pollution meteorology
4. Measurement of ambient air quality
5. Ambient air quality criteria and standards
6. Technical approaches to control of air pollution emissions
7. Program management
8. Air pollution rules and regulations
9. Enforcement organization and method

II Air Pollution Meteorology — 3 units

A. Lecture and Laboratory

1. Meteorological fundamentals
2. Effects of meteorological parameters on transport and diffusion
3. Meteorology and air pollution effects in urban areas
4. Atmospheric diffusion estimates
5. Effective stack height
6. Meteorological instruments and exposure
7. Analysis of air quality and meteorological data
8. Air pollution surveys
9. Forecasting air pollution potential
10. Meteorological models for air pollution control strategies

III. Atmospheric Sampling — 3 units

A. Lecture

1. Impactors and impingers
2. Filtration
3. Electrostatic precipitators
4. Thermal precipitators
5. Design of sampling systems, including a discussion of air movers and air-measuring devices
   a. Evaluation of filter media
   b. Grab sampling
   c. Freezeout and condensation
   d. Absorption
   e. Sampling for respirable dusts
   f. Sample site selection
   g. Preparation of controlled concentrations

B. Laboratory

1. Calibration of these air-measuring instruments:
   - Wet test meter
   - Dry test meter
   - Rotameter
   - Limiting orifice meter
   - Calibration of a high-volume sampler
   - Calibration of a tape sampler
   - Determination of collection efficiencies
   - Introduction to continuous monitoring instrumentation
   - Dynamic and static methods of calibration of continuous monitoring instruments

IV. Source Sampling — 3 units

A. Lecture

1. Basic theory
2. Source sampling fundamentals
3. Gas flow measurements
4. Collection devices and media
5. Analytical procedures
6. Design of source sampling trains
7. Sampling train aids
8. Considerations at the source
9. Source sampling monitors

V. Analysis of Atmospheric Inorganics — 3 units

A. Lecture

1. Analysis for oxides of nitrogen
2. Analysis for oxides of carbon
3. Analysis for sulfur compounds
4. Analysis for oxidants
5. Analysis for sulfates and chlorides
6. Analysis for flourides
7. Analysis for metals
8. Measurement of radionuclides in the atmosphere
9. Calibration of sampling trains
10. Electrical methods of analysis
11. Optical methods of analysis
12. Automatic and continuous monitoring

B. Laboratory

1. Determination of sulfur dioxide (manual method)
2. Determination of nitrogen dioxide (manual method)
3. Determination of oxidants (manual method)
4. Continuous monitoring of selected pollutants

VI. Analysis of Atmospheric Organics — 3 units

A. Lecture
1. Nomenclature of organic compounds
2. Sampling for organic compounds
3. Theory and application of column chromatography
4. Introduction to thin-layer chromatography
5. Introduction to gas chromatography
6. Absorption spectroscopy
7. Activation analysis of air pollutants
8. Preparation of controlled atmospheres

B. Laboratory
1. Separation of organic pollutants
2. Ultra-violet absorption analysis
3. Visible absorption analysis
4. Gas chromatographic analysis
5. Infrared analysis

VII. Air Pollution Microscopy — 3 units

A. Lecture and Laboratory
1. Sampling for particulates
2. Optics and illumination
3. Polarization and the polarizing microscope
4. Morphology of natural particulates
5. Morphology of industrial dust and combustion products
6. Micrometry--counting and sizing
7. Crystal morphology
8. Measurement of refractive index
9. Dispersion staining
10. Photomicrography

VIII. Statistical Data Evaluation — 3 units

A. Lecture
1. Storage and retrieval of air pollution data
2. Principles of data handling
3. Basic concepts of sampling
4. Experimental design and analysis
5. Linear regression
6. Time series analysis
7. Techniques for analyzing special air pollution data

IX. Control of Gaseous and Articulate Emissions — 3 units

A. Lecture

1. Absorption
2. Adsorption
3. Combustion control equipment
4. Odor control

5. Particle size technology

6. Control of coarse particles

7. Control of fine particles

8. Industrial applications

27 units

COURSE TOTAL

Recommended texts: Air Pollution, second edition, Edited by Arthur C. Stern, Academic Press, 1968.

Quantitative Analysis of Gaseous Pollutants, Walter E. Ruch, Ann Arbor-Humphrey Science Publishers, Inc., 1970.

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ENVIRONMENTAL RESOURCES TECHNICIAN

Purpose of the Curriculm: Courses offered in this program are designed to give the student a broad background in environmental science in order to research and gather information for environmental impact report preparation or for related environmental/ecological resource gathering functions in a special area such as planning or engineering.

Course Structure and Organization: 30 units of course work in various areas of environmental and related sciences primarily at the introductory levels. These courses are supported by relevant, required courses that are in partial fulfillment of the general education pattern as well as suggested electives for a specialty major in one of the several areas of specialty in environmental impact report preparation.

Topic Outline: Requirements in the core area are:

I.	Introduction to Ecology	3 units
II.	Environmental Psychology	3 units
III.	Graphics	3 units
IV.	Introduction to Waste Water	3 units
V.	Environmental Impact Report Preparation	3 units
VI.	Introduction to Theory of Sound	3 units
VII.	Technical Mathematics	3 units
VIII.	Basic Electronics	3 units
IX.	Ocean Resources	3 units
X.	Introduction to Air Pollution	3 units
	TOTAL	30 units

Optional courses for specialty can be taken from the following areas: pre-engineering, chemistry, advanced technical report writing, advanced drafting, economics, marine biology, agriculture-soils, air technology, water/waste water technology and noise abatement.

Introduction to Ecology
Course Description

(18 week course) 3 c

Prerequisite: None

Catalog description: Includes the physical and biological components of the environment and their interrelationships. Suitable as a general education elective for the non-science major and also for students in Environmental Science or other natural sciences.
3 hours lecture.

For Whom the Course is Intended: All students.

Text and Materials: Ehrenfeld, Biological Conservation.
Kormondy, Concepts of Ecology.

Method of Instruction: Lecture.

Course Objectives: At conclusion of the course, student should have a better understanding of the interaction between physical and biological components of the environment and their interrelationships.

Topic outline:

Orientation
Scope of Ecology
Ecology and its relevance to other sciences
The Ecosystem
Energy Flow
Biogeochemical Cycles
Photosynthesis-Physical Laws
Photosynthesis
Ecological Indicators
Energy in Ecosystems
Limiting Factors
Population Ecology
Natural Selection
Isolation
Adaptation
Biological Interactions
Ecological Succession
Ecological Approach to Habitat Study
Marine Ecosystem
Freshwater Ecology
Applied Ecology

Evaluation: 3 exams, 1 literature survey equal in value to one exam.

NA-1 Introduction to Theory of Sound
Course Description

3 units

Description of Course: A math-oriented, non-calculus examination of theory and principles of application concerning the following features of sound with respect to measurement and interrelationships.

Vibration
Simple harmonic motion
Wave phenomena
Energy
Propagation
Amplitude
Frequency
Wave length
Velocity
Conduction
Reflection and Echoes
Absorption
Resonance and interference
Refraction
Sound vs. Noise
Hearing
Loudness
Pitch
Discrimination
Weber's Law
Fechner's Law
Phons
Sones
Decibels
Decibels - absolute energy
Decibels - reference noise
Sound pwoer
Ambient noise
Threshold of hearing
Range of audibility
Curves and Graphs

Prerequisites: Mandatory concurrent enrollment in Technical Math. of Sound I.

Environmental Psychology
Course Description

(18 week course) 3 units

Catalog Description: Exploration of the effects the physical environment has on man's behavior. Topics examined will include crowding, territoriality, privacy, social behavior in urban and rural environments, planned communities, and unusual and natural environments.
2 hours lecture.

For Whom the Course is Intended: Primarily for psychology and students majoring in Environmental Programs. However, this course emphasizes a multi-disciplinary approach to man and environment and is open to all students.

Text: Proshansky, Ittelson and Rivlin. Environmental Psychology: Man and His Physical Environment.

Instructional Methods:

1. Lectures (campus and outside speakers)
2. Readings and discussions
3. Field trips and films
4. Term projects and presentations
5. Seminars and debates

Course Objectives:

1. To define and clarify the scope, origins, and objectives of environmental psychology.
2. To explore the effects of man's environment on human behavior.
3. To provide the student the tools and techniques for studying man's behavior as he functions in the physical environment.
4. To develop a knowledge and understanding of the impact of cultural bias on man's perception of the environment.
5. To encourage a familiarity with the writings of the major contributors to theory and empirical work focusing on the inter-disciplinary study of this discipline.
6. To develop a sensitivity to environmental problems, especially those concerned with interrelationship between man and the physical environment.

Topic Outline:

I. Micro-environment

Effect of spatial distance and configuration on social interaction; the determinants of spatial distances; spatial behavior in children and adults; cross-cultural comparisons. Experimental studies of effects of crowding; theories of crowding, etc.

II. Architecture and Housing

Effects of design on social behavior; privacy; use and control of space ("Territoriality"); effect of design on friendship patterns and child rearing; unusual environments, etc.

III. Special Environmental Settings

Schools, traditional and open-space design; institutions--prisons; hospitals, mental and physical, etc.

IV. Macro-environments

Behavior in cities and small towns; positive and negative aspects of slums; research on planned communities, etc.

V. Natural Environments

Response to non-manmade environments; preference for types of natural settings; recreation, behavior, etc.

Graphics
Course Outline

(18 week course) 3 units

Catalog Description: Introduction to equipment, materials and techniques of drawings, graphic symbols and procedures. Study of communication through plans and drawings. Laboratory work includes preparation of the models, maps, charts, graphics, duplicating techniques and the use of audio-visual aids. 1 hour lecture, 3 hours laboratory.

For Whom the Course is Intended: The beginning student in urban planning.

Text: Giesecke, Frederick E., Alva Mitchell and Henry Cecil Spencor, Technical Drawings, 4th Edition, The Macmillan Co., N.Y., 1958.
Ramsey, George C. and Harold R. Sleeper, Architectural Graphic Standards, John Wiley and Sons, N.Y., 1965.

Method of Instruction: Lecture, illustrative drawings, individual review of student work by instructor, and intra-class jury.

Course Objectives: To familiarize the student with equipment, materials, and techniques of drafting and to expose the students to graphic symbols and procedures. The course will concentrate on proper means to communicate through plans and drawings.

Evaluation Plan: Examinations, problems, and notebook will be graded on a point basis. Grading will reflect student's proficiency in the use of drafting equipment, the preparation of the required drawings, and an understanding of graphic techniques.

Topic Outline:

1. Background
2. Use of Drafting equipment and materials
3. Freehand pencil lettering
4. Lines
5. Scales
6. Plant materials
7. Symbols for construction drawings
8. Masonry construction
9. Freehand ink lettering
10. Ink lines
11. Ink problems; subdivision and base maps
12. Combined pencil and ink problems:
    - Parking Standards
    - Cluster Development
    - Civic Center
13. Topography
14. Aerial photography
15. Models
16. Applied materials
17. Base materials
18. Adhesives and fixatives
19. Graphic presentations
20. Projection techniques
21. Displays and exhibitions
22. Reproduction processes
23. Preparing for publication

Environmental Impact Report Preparation
Course Description

(18 week Course) 3 units

Prerequisite: None

Catalog description: To provide training and practical experience in the preparation of Environmental Impact Statements. A review of the pertinent Federal and State legislation and judicial rulings will preface a detailed study of model guidelines actually in existence, detailed examination and critique of statements that have already been prepared and reviewed, all in context with actual preparation of an Environmental Impact Statement for an appropriate actual current development. 3 hours lecture, 3 hours laboratory

For Whom the Course is Intended: Personnel employed in planning departments, development firms.

Text and Materials: Instructor's choice.

Method of Instruction: Lecture, discussion, review, analysis, case study and statement preparation.

Course Objectives: To permit the student to acquire skills permitting him to function productively in the research for, preparation of, or review of Environmental Impact Statements.

Topic Outline:

Week 1 Background:
a. Review of Federal Legislation
b. Review of State Legislation
c. Review of Supreme Court Decision

Week 2 Model Local Guidelines:
a. Review of Costa Mesa Planning Department Guide
b. Review of Orange County Guidelines if available
c. Review of State guidelines if available
d. Review of California League of Cities Guide

Weeks 3-17 Detailed review and analysis of model statements and evaluations thereof with instructions for and preparation of segments of Environmental Impact Statements.

Week 3 Summary Project Description, Extent of Area potentially affected by Project, and Project Timing/Schedule

Week 4 Environmental Factors to be Considered
1. Air Quality and Climate
a. Pollution

Week 5
b. Odors
c. Clarity
d. Weather and Climate

Week 6 2. Water Resources
a. Quality of water

Week 7 b. Water Storage

Week 8 3. Noise

Week 9 4. Geology, Topography, Landform, & Soils

Week 10 5. Other Resources

Week 11 6. Habitat
a. Human

Week 12 b. Wildlife

Week 13 7. Land use

Week 14 Expansion of Potential Problem Areas

Week 15 Specific Questions to be Answered

Week 16 Evaluation of Term Group Projects

Week 17 Final Examination

Given: A presentation of researched facts & companion EIS.

Required: Review & Revision of EIS in light of facts.

Evaluation Plan: Evaluation is based on quality team project and final individual effort.

Chemistry for Technicians
Course Description

(18 week course) 4 units

Catalog Description: An introduction to the practical aspects of inorganic and organic chemistry as related to environmental and marine science, biology and allied health.

Method of Instruction: 3 hours lecture, 3 hours laboratory per week.

Course Objectives: Upon successful completion of the course, the student will be able to perform simple chemical calculations, will be familiar with chemical laboratory procedure, and will be able to perform laboratory experiments such as dilutions and titrations.

Topic Outline:

I. Inorganic Chemistry
Units of Measurement
Properties and Structure of Matter
Radioactivity
Chemical Bonding
Chemical Equations
The Gas Laws
Oxidation-Reduction
Liquid Mixtures
Acids and Bases, Salts
Ionization
Titration

II. Organic Chemistry
Introduction to Organic Chemistry
Hydrocarbons
Alcohols and Ethers
Other Organic Compounds
Cyclic Compounds
Heterocyclic Compounds

Evaluation Plans: Tests, laboratory exercises.

(Week)	
5	Environments of Resources (General)
6	Recreation
7	Saline Water +? = Fresh Water
8	Waste Disposal in the Sea
9	Minerals
10	Minerals
11	Food from the Sea
12	Food from the Sea
13	Food from the Sea
14	USES OF THE SEAS - Introduction and Chapter 1
15	USES OF THE SEAS - Chapters 2 and 3
16	USES OF THE SEAS - Chapters 4 and 5
17	USES OF THE SEAS - Chapters 6, Project Due
18	Review, FINALS

Evaluation Plan: Written examinations on lecture, field work and field trip material; a project involving the student's major and marine science.

Ocean Resources
Course Description

(18 week course) 3 units

Prerequisite: Marine Science 100

Catalog Description: Renewable and non-renewable resources including interrelationships of tides, waves and beaches, resource management ocean transportation, ocean recreation, fresh water from the sea, ocean contaminates and pollution. Laboratories are comprised of field work, on-campus laboratories and field trips. Some field trips may be arranged at other tha scheduled laboratory time, including weekends, to industrial organizations engaged in resource utilization and public agencies engaged in resource management.
2 hours lecture, 3 hours laboratory or field/clinical.

For Whom the Course is Intended:

1. For students who wish an exploratory course to assist them in making a choice of an academic major.
2. For students who wish a general orientation to the resources of the sea which will better enable them to appreciate the role of the sea on the lives of citizens of the 20th Century.

Text and Materials: Gullion, Uses of the Seas.
Supplemental "handout" materials will be prepared and presented to the students on a weekly basis.

Method of Instruction: Lectures utilizing visual aids as much as possible with correlative field work and trips to governmental and industrial organizations involved in ocean work.

Course Objectives:

1. To provide a general education elective course which will provide the student with an understanding and appreciation of the ocean as a resource.
2. To provide a second course in a series of four courses required of students in the Marine Technology Program.
3. To offer an elective for transfer students.
4. To provide an "interest" course of an exploratory nature. From the course in ocean resources some students may elect to continue in the marine sciences or to enter the Marine Technology Program.

Topic Outline:

(Week)

1 Introduction, General Review
2 Tides
3 Waves
4 Beaches

Basic Electronics
Course Description

(18 week course) 3 units

Catalog description: An introduction including applications of electronic magnetism, resistance, inductance, capacitance, vacuum tubes, and semiconductors as they apply to devices used throughout the broad field of electronics. Provides the foundation for specialized options in electronics including avionics, radio communications, computer systems, and services.
5 hours lecture, 6 hours laboratory, 3 hours seminar

For Whom the Course is Intended: Pre-employment occupational program; State college transfer for selected majors.

Text and Materials: Text and films

Method of Instruction: Text and films

Course Objectives: To develop knowledge of characteristics of electronic components and devices and to develop a skill in the use of typical electronic instruments.

Topic Outline:

1. Student orientation to college and facilities.
2. Safety in electronics
3. Discussion of electronic systems: radio
4. Introduction to system components: block diagrams
5. Introduction to resistance circuits, networks
6. Introduction to magnetism, electromagnetism
7. Introduction to alternating current fundamentals
8. Inductance
9. Transformers
10. Capacitance
11. Time constants
12. Diode devices

Evaluation Plan: Homework, quizzes, final exam and laboratory experiments.

Technical Mathematics
Course Description

(18 week course) 3 units

Prerequisites: Algebra, Geometry, Elementary Trigonometry

Catalog description: Emphasis on the industrial application of algebra, trigonometry, slide rule, vector analysis, analytical geometry, and graphical solutions of industrial problems. Introduction to probability and statistics. 4 hours class activity per week.

For Whom the Course is Intended: The course is intended for pre-employment, occupational students and industrial workers needing increased proficiency in technical mathematics.

Text and Materials: Auerbach and Groza, Introductory Math for Technicians.

Method of Instruction: Class demonstration and discussion, open work periods, homework assignments, quizzes, and examinations.

Course Objectives: The course is designed to provide opportunity for the acquisition of mathematical proficiency beyond basic job-entry requirements.

Topic Outline:

Linear Relationships
Algebraic Functions
Graphical Relationships

Course Outline:

Trigonometric Functions
Right-angle trigonometry as applied to industrial problems
Oblique-angle trigonometry as applied to industrial problems
Vectors
Radicals and exponents
Second degree equations
Graphical solution
Systems of linear equations
Simultaneous solutions
Determinants
Logarithmic theory
Exponential relationships
Log-log sliderule

Applications of the above to industrial problems

Evaluation Plan: Evaluation of student performance is based equally upon homewor quizzes and examinations.

Selected Bibliography

Number	Source
1.	"Manpower For Environmental Protection." Ralph C. Graber, Frederick K. Erickson, and William B. Parsons, (Environmental Protection Agency, Washington, D. C.) Environmental Science and Technology, Vol. 5 No. 4, April 1971, P. 319.
2.	"Jobs in the Environmental Field." Stan Miller and Marty Malin, Environmental Science and Technology, Vol. 6 No. 8, August 1972, P. 695.
3. & 4.	"Manpower Development and Training." Richard F. Guay, Water Pollution Control Federation, II-1a 1973, P.6.
5.	Occuaptional Outlook Quarterly, M. Fountain and K. Hoyle, "News" U.S. Department of Labor. A.M. Edition, May 4, 1973.

APPENDIX I

SURVEY DATA

Number of Contacts	Type of Contact	Responses
36	Letters to Colleges	36
60	Questionnaires to Environmental Classes	40
350	Form Letters	185
30	Personal Conferences	30
75	Phone Contacts	50
551 TOTAL CONTACTS		341 TOTAL RESPONSES

APPENDIX II

The first two questionnaires were distributed to classes of 30 students each. The questionnaire titled, Environmental Impact Statements was given to students who were taking a class in enivronmental impact report preparation which is of offered at Orange Coast College. The students consisted of people currently in the field and those who wish to be employed in an environmentally related occupation.

The other questionnaire was given to members of an occupational safety and health class also at Orange Coast College. The students consisted primarily of people currently involved in safety and health in the general area of Costa Mesa.

The ideas reflected in this survey are the essence of the responses from the questionnaires, the form letters, the phone calls and the personal conferences.

APPENDIX II

ENVIRONMENTAL EDUCATION NEEDS STUDY

Name_____

Company_____

Address_____

Telephone_____

1. Why are you taking this course?

2. Is there another course related to safety and health that you would take?

3. What is the nature of function of your company or agency?

4. How many people are employed by your company in the area of occupational safety and health?

5. What kind of training program would you deem desireable for a technician? Why?

6. Do you feel that the 1970 Occupational Safety and Health laws will increase the need for occupational safety and health technicians at your company?

7. Please add any comments you feel would be helpful in our evaluation of the need for occupational safety and health technicians.

8. Please add the names and addresses of any others whom you feel would have information regarding present and future employment needs in the area of occupational safety and health.

APPENDIX II

OPTIONAL (NAME_____

(ADDRESS_____

(_____

(PHONE_____

ENVIRONMENTAL
IMPACT STATEMENTS

1. Name and address of your present employer

_____

2. What is your current position?

_____

3. How many people are employed by your firm?

_____

4. Why are you taking this course?

_____

5. What other course(s) do you desire or visualize your employer desires offered in the areas associated with Environmental Impact Statements?

_____

6. Based on your knowledge of your employer's needs and/or the needs of related firms or agencies, what are the requirements (numbers-jobs?) for technicians in any of the areas associated with environmental imapct statements?

_____

7. Please add any comment you feel might permit us to evaluate the magnitude of the need for technicians in the preparation of environmental impact statements.

_____

8. Please add the names and addresses of any others whom you feel might give us leads as to present and future employment and/or training requirements in the areas of environmental concern.

_____

_____

_____

APPENDIX II

ORANGE COAST COLLEGE

2701 FAIRVIEW ROAD
COSTA MESA CALIFORNIA 92626

Dear Sir:

The Coast Community College District has been assigned by the Division of Occupational Education, California Community Colleges, the project of preparing a "Handbook for Environmental Manpower and Training". The completion of the project will result in the compilation of the "Handbook".

The "Project" will address itself specifically to the following points:

1. Job titles and job performance requirements in environmental occupations.

2. Types of employment available in environmental occupations.

3. Current needs for Environmental Technicians.

4. Future employment opportunities for Enviornmental Technicians.

5. Types of training being offered in environmental occupations.

In this, our initial contact with your institution, we are attempting to determine the kinds of programs offered in enviornmental occupations. We wish to have your institution represented in our survey and we ask your assistance in helping us with our project by responding to the enclosed questionnaire.

In the event it is more appropriate for another staff member to respond, please route this material to the appropriate person. It is desireable to have the questionnaire returned as soon as possible so that we may begin to tabulate our data.

Thank you for your kind cooperation.

We have enclosed worksheets listing the needed information and prompt attention to this matter would be greatly appreciated.

Thank you.

Sincerely,

QUESTIONNAIRE

Training of Environmental Technicians

Name of Institution: _____

Address: _____

_____

(City) (State) (Zip)

Name of Person Responding: _____

Title: _____

(Phone)

1. We do/do not offer training in environmental occupations. (circle one)

2. Give name(s) or title(s) of your two-year program(s).

_____ _____

_____ _____

3. We do/do not offer special programs which are less than two-years in length. (circle one)

4. Give name(s) or title(s) of your program(s).

_____ _____

_____ _____

APPENDIX II

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The Project will address itself specifically to the following points:

1. Job titles and job preformance requirements in environmental occupations.

2. Types of employment available in enviornmental occupations.

3. Current needs for Environmental Technicians.

4. Future employment opportunities for Environmental Technicians.

We are aware of the magnitude of our assignment and are quite conscious of the fact that the assistance of many individuals will be required to successfully complete our tasks.

We are not aware of any "list" of environmental occupations therefore, one of the initial goals is the compilation of a list of job titles and job specifications for Environmental Technicians.

Your agency has been identified as one that is most likely aware of job titles and job specifications utilized in recruiting and/or promoting employees in your agency or organization.

Our request is for specific information concerning job titles and job specifications for para-professionals or technicians whom you employ.

When we have prepared, with your assistance, a composite list of Enviornmental Technicians, with job titles and job specifications, it is our plan to share with you the results of our efforts.

We have enclosed worksheets for your convenience. Please enter job titles, job specifications and required skills on the worksheets and return in the enclosed envelope.

Sincerely,

APPENDIX II

JOB TITLES, JOB SPECIFICATIONS AND REQUIRED SKILLS
FOR ENVIRONMENTAL TECHNICIANS

Job Title	Job Specifications	Required Skills
(Example)	(Example)	(Example)
Waste water Treatment Plant Operator, Grade IV	Operate and/or properly maintain waste water treatment units; completion of one year full-time employment in actual operation of a waste-water treatment plant.	Demonstration of an overall working knowledge of the unit operations of the waste water treatment plant where applicant is employed.

APPENDIX II

JOB TITLES, JOB SPECIFICATIONS
AND REQUIRED SKILLS FOR
ENVIRONMENTAL TECHNICIANS

JOB TITLE	JOB DESCRIPTION	EDUCATION

EXPERIENCE	CURRENT MANPOWER NEED	PROJECTED MANPOWER NEED

MASTER LIST OF DISTRICT COLLEGES - COMMUNITY COLLEGES

Institute	Contact	Curricula
Allan Hancock College 800 South College Drive Santa Maria, Ca. 93454	Ray Mills, Dean Voc. Tech. ed.	Eight (8) different course titles
Antelope Valley College 3041 West Avenue K Lancaster, Ca. 93534	Dr. Richard W. Malcolm	1 or 2 courses not termed a program
Barstow Community College 2700 Barstow Road Barstow, Ca. 92311	Robert Vencill Chairman, Science Div.	no program offered
Canyons, College of the 25000 W. Valencia Blvd. Valencia, Ca. 91355	Mr. Robert Pollock Dean, Vocational-Technical Ed.	No program offered
Cerritos College 11110 E. Alondra Blvd. Norwalk, Ca. 90650	R. Whiteman Dean of Vocational Training	No program
Chaffey College 5855 Haven Avenue Alta Loma, Ca. 91701	Dr. Henry E. Childs, Jr. Vice Pres., Instruction	1 or 2 courses
Citrus College 18824 E. Foothill Blvd. Azusa, Ca. 91702	Mr. Leo M. Thomas Vice Pres./Asst. Supt., Instruction	1 course
Compton College 1111 E. Artesia Blvd Compton, Ca. 90221	Dr. John A. Grande Dean of Instruction	1 course
Cypress College 9200 Valley View Street Cypress, Ca. 90630	Mr. Chester Gromacki District Director of Vocational Ed.	1 course
Desert, College of the 43-500 Monterey Avenue Palm Desert, Ca. 92660	Kenneth W. Waters Chairman Agriculture Dept.	No program now, In process of developing one
East Los Angeles College 5357 E. Brooklyn Avenue Los Angeles, Ca. 90022	Arthur N. Cherdack Coordinator of Institutional Research	No training- special programs - 1 environmental science course
El Camino College 16007 Crenshaw Blvd. Vai Torrance, Ca. 90506	Dr. H. M. Maddaford Dean of Instruction-Administrative	No training

Fullerton Junior College 321 East Chapman Avenue Fullerton, Ca. 92634	Dr. Philip W. Borst Asst. Dean of Instruction	No program
Glendale College 1500 North Verdugo Road Glendale, Ca. 91208	Mr. Thomas S. Ryan Dean of Occupational Educ.	1 course
Golden West College 15744 Huntington Beach Blvd. Huntington Beach, Ca. 92647	Dr. William F. Shawl Dean of Academic Affairs	No training program
Long Beach City College 4901 East Carson Street Long Beach, Ca. 90808	Mr. William F. Waechter Dean, Instruction	No program
Los Angeles City College 855 North Vermont Avenue Los Angeles, Ca. 90029	Mr. Louis F. Hilleary Dean of Instruction	No program
Los Angeles Harbor College 1111 Figueroa Place Wilmington, Ca. 90744	Mr. Kermit Dale Dean of Instruction	No program (several courses)
Los Angeles Pierce College 6201 Winnetka Avenue Woodland Hills, Ca. 91364	Mr. Ray Johnson Dean of Instruction	No Program
Los Angeles Southwest College 11514 South Western Ave. Los Angeles, Ca. 90047	Mr. J. R. Heusdens Assistant Dean	No Program
Los Angeles Trade-Technical College 400 West Washington Blvd. Los Angeles, Ca. 90015	Dr. Franklin R. Johnson Dean of Instruction and Curriculum	No Program
Los Angeles Valley College 5800 Fulton Avenue Van Nuys, Ca. 91401	Dr. Stewart Marsh Dean of Instruction	No Program
Mount San Antonio College 1100 North Grand Avenue Walnut, Ca. 91789	Mr. John W. Douthit Bio. Sci. Dept.	No Program
Mount San Jacinto College 21-400 Foothill Road P.O. Box 248 Gilman Hot Springs, Ca. 92340	Mr. Lew Canter Dean of Academic Instruction	No program 1 course: Environmental Science I

Orange Coast College 2701 Fairview Road Costa Mesa, Ca. 92622	Samuel R. Petersen Associate Dean Director of Federal Projects	Training: Yes Environmental Tech. Pollution Abatement Tech. Special Programs: Pollution Abatement Tech.; Water Skill Center training for Military personnel
Palo Verde College 811 West Chanslorway Blyth, Ca. 92225	Dr. Earl F. Schlick Dean of Instruction	No program
Pasadena City College 1570 East Colorado Blvd. Pasadena, Ca. 91106	J. R. Toothaker, Director Occupational Education	No program
Rio Hondo College 3600 Workman Mill Road Whittier, Ca. 90608	Mr. Morris C. Bergen Vice Pres., Academic Affairs	No program
Riverside City College 4800 Magnolia Riverside, Ca. 92506	Mr. Arthur J. Schechter Dean of Instruction	No program 1. Environmental Sci. 2. Applied Science 3. Resource Sciences
Saddleback College 28000 Marguerite Parkway Mission Viejo, Ca. 92675	Mr. Rufus L. Platt Dean of Instruction	No Program
San Bernardino Valley College 701 S. Mt. Vernon Ave. San Bernardino, Ca. 92403	F. Bryce Stewart Dean of Occupational Educ.	No programs. Long range plans include general heading.
Santa Ana College 17th Street at Bristol Santa Ana, Ca. 92706	Paul Roman, Dean of Urban Studies	Program offered No placement science per se Day & night students Outstanding students recommended to employ.
Santa Barbara City College 721 Cliff Drive Santa Barbara, Ca. 93109	Tom MacMillan Director Research	No program
Santa Monica College 1815 Pearl Street Santa Monica, Ca. 90406	Fred J. Brierici, Dean Occupational Education	No program
Victor Valley College 18422 Bear Valley Road Victorville, Ca. 92392	Mr. Gordon W. Blaisdell Dean of Instruction	No program
West Los Angeles College 4800 Freshman Drive Culver City, California 90230	Dr. Norman C. Chapman Dean of Instruction	No Program

MASTER LIST AGENCIES

AGENCY	CITY	COUNTY
Agriculture and Air Resources Board	Anaheim	Orange
Agriculture (Department of)	Sacramento	All Counties
Agri-Science Laboratories Inc.	Hawthorne	Los Angeles
Air Pollution Control Board	Santa Barbara	Santa Barbara
Air Pollution control District	Riverside	Riverside
Air Resources Board	Sacramento	All Counties
Air Resources Board	Los Angeles	Los Angeles
Air-Sanitation-Air Resources Board	Sacramento	All Counties
Alhambra (City of)	Alhambra	Los Angeles
American Acoustics Co. John Van Houten	Anaheim	Orange
American Standards Testing Bureau, Inc.	Los Angeles	Los Angeles
Anaheim (City of)	Anaheim	Orange
Arcadia (City of)	Arcadia	Los Angeles
Archaeological Research, Inc. Roger Desantels, Pres. & Chrmn.	Costa Mesa	Orange
Armstrong Petroleum Corporation	Newport Beach	Orange
Arrowhead Puritas Waters	Los Angeles	Los Angeles
Artesia (City of)	Artesia	Los Angeles
Associated Engineers & Planners	Newport Beach	Orange
Atlantis Scientific J.J. Moore	Beverly Hills	Los Angeles
Atlantic Research Corporation	Costa Mesa	Orange
Atlantis Scientific R.L. "Bob" Ollinger	Beverly Hills	Los Angeles
Automotive Environmental Systems, Inc.	San Bernardino	San Bernardino
Azuza (City of)	Azuza	Los Angeles
Babcock (Ed. S.) and Sons	Riverside	Riverside

AGENCY	CITY	COUNTY
Baldwin Park (City of)	Baldwin Park	Los Angeles
Banning (City of)	Banning	Riverside
Barstow (City of)	Barstow	San Bernardino
Beckman Industries	Fullerton	Orange
Bell (City of)	Bell	Los Angeles
Bellflower (City of)	Bellflower	Los Angeles
Bell Gardens (City of)	Bell Gardens	Los Angeles
Beverley Hills (City of)	Beverly Hills	Los Angeles
Bio Laboratories Medical Group, Inc.	Colton	San Bernardino
The Biome Company, Inc. Don Mitchell	Costa Mesa	Orange
Bio-Science Labs	Van Nuys	Los Angeles
Bio-Technics Labs, Inc.	Los Angeles	Los Angeles
Boyle Engineering Mr. Lord	Santa Ana	Orange
Brea (City of)	Brea	Orange
Buena Park (City of)	Buena Park	Orange
Burbank (City of)	Burbank	Los Angeles
Calif. Museum of Science & Industry	Los Angeles	Los Angeles
Calif. State Fisheries Laboratory	Long Beach	Los Angeles
Calif. State Personnel Board	Sacramento	All Counties
Calif. Vehicles Emissions Test Center	Anaheim	Orange
Camay Drilling Co.	Los Angeles	Los Angeles
Carpenteria (City of)	Carpenteria	Santa Barbara
Carpenteria County Water District	Carpenteria	Santa Barbara
Carpenteria Sanitation District	Carpenteria	Santa Barbara
Carson (City of)	Carson	Los Angeles
Celesco Industries	San Diego	San Diego
Center for Environmental Affairs	San Jose	Santa Clara
Cerritos (City of)	Cerritos	Los Angeles
Chino (City of)	Chino	San Bernardino
Conservation (Dept. of) (Div. of Oil and Gas)	Sacramento	All Counties
Conservation (Dept. of) (Div. of Oil and Gas)	Inglewood	Los Angeles
Claremont (City of)	Claremont	Los Angeles
Clean Seas, Inc.	Santa Barbara	Santa Barbara

AGENCY	CITY	COUNTY
Coca-Cola Bottling Company	Los Angeles	Los Angeles
Colorado River Board of California	Los Angeles	Los Angeles
Colton (City of)	Colton	San Bernardino
Commerce (City of)	Commerce	Los Angeles
Community Planning (Director of)	Los Angeles	Los Angeles
Compton (City of)	Compton	Los Angeles
Conservation (Department of)	Sacramento	All Counties
Corona (City of)	Corona	Riverside
Covina (City of)	Covina	Los Angeles
Cudahay (City of)	Cudahay	Los Angeles
Culver City (City of)	Culver City	Los Angeles
Cypress (City of)	Cypress	Los Angeles
Danielian, Moon, Sampieri & Ilg	Newport Beach	Orange
J.F. Davidson Assoc.: Impact Group	Riverside	Riverside
Daylin Laboratories Inc.	Los Angeles	Los Angeles
Development Research Association	Los Angeles	Los Angeles
Downey (City of)	Downey	Los Angeles
Duarte (City of)	Duarte	Los Angeles
The Earth Alliance Anthony M. Grasso	S. Laguna	Orange
Earth Resources Analysis Group Miran A. Romero, Co-ordinator	Montrose	
Edison	Huntington Beach	Orange
Education (Orange County Dept. Of)	Santa Ana	Orange
E. G. & G. Inc. (Nuclear Research	Santa Barbara	Santa Barbara
El Monte (City of)	El Monte	Los Angeles
El Segundo (City of)	El Segundo	Los Angeles
Elsinore (City of)	Elsinore	Riverside
El Toro Water District	El Toro	Orange
Engineering-Science, Inc.	Arcadia	
Envirometrics International	Fullerton	Orange
Environmental Analysis	Whittier	Los Angeles
Environmental Analysis Systems, Inc.	La Mesa	
Environmental Assessment Engineering	Sacramento	

AGENCY	CITY	COUNTY
Environmental Biologists & Consultants Bob L. Pope, Fellce C. Movich	Garden Grove	Orange
Environmental Concern, Inc. Shadow Bailey	Laguna Beach	Orange
Environmental Health Consultation Svc. Robert A. Shakman	Ojai	
Environmental Health & Consumer Protection Program	Berkeley	All counties
Environmental Health Department	Anaheim	Orange
Environmental Impact Reports, Inc.	Costa Mesa	Orange
Environmental Impact Science, Inc.	Newport Beach	Orange
Environmental Quality Analysts, Inc.	Alhambra	
Environmental Research & Technology, Inc.	Newport Beach	Orange
Envista, Inc.	Anaheim	Orange
Evaluation Research Corporation	Huntington Beach	Orange
EWA (Eugene D. Wheeler & Associates)	Ventura	Ventura
Fire Marshall (State)	Sacramento	All Counties
Fish and Game (Department of)	Long Beach	Los Angeles
Flood Control District	Santa Barbara	Santa Barbara
Flood Control District	Santa Ana	Orange
Fontana (City of)	Fontana	San Bernardino
Forestry (Calif. Div. of)	Orange	Orange
Forestry (Div. of) - Dept. of Conservation	Sacramento	All counties
Fountain Valley (City of)	Fountain Valley	Orange
Frederiksen Engineering Co., Inc. Mr. W. C. Frederiksen	Oakland	
Fullerton Airport	Fullerton	Orange
Fullerton (City of)	Fullerton	Orange
Fullerton School District	Fullerton	Orange
G. M. Cal Vehicle Emissions Lab.	El Segundo	Los Angeles
Gardena (City of)	Gardena	Los Angeles
Garden Grove (City of)	Garden Grove	Orange
Garrett Research & Development Co.	La Verne	Los Angeles
General Automotive	Anaheim	Orange
George W. Gooch Labs., Ltd.	Los Angeles	Los Angeles
Glendale (City of)	Glendale	Los Angeles
Glendora (City of)	Glendora	Los Angeles
Gulf Oil Corporation	Santa Fe Springs	Los Angeles
Gulf Oil - U. S. Refinery	Santa Fe Springs	Los Angeles

AGENCY	CITY	COUNTY
Halliburton Services	Santa Fe Springs	Los Angeles
Halliburton Services	Los Angeles	Los Angeles
Hallister's Nursery & Flower Shop	Costa Mesa	Orange
Harbors, Beaches & Parks Dist. Orange County	Newport Beach	Orange
Harbors, Beaches & Parks Dist. Orange County	Santa Ana	Orange
Haworth & Anderson	Tustin	Orange
Hawthorne (City of)	Hawthorne	Los Angeles
Health Department (Orange County)	Santa Ana	Orange
Health Department Medical Center	Santa Ana	Orange
Health Office (Orange County)	Santa Ana	Orange
Hemet (City of)	Hemet	Los Angeles
Hermosa Beach (City of)	Hermosa Beach	Los Angeles
HIghways (Division of)	Orange	Orange
John K. Hilliard	Santa Ana	Orange
Holm, Tait & Associates	Anaheim	Orange
Human Resources and Development (Dept. of)	Sacramento	All Counties
Huntington B ach (City of)	Huntington Beach	Orange
Huntington Park (City of)	Huntington Park	Los Angeles
Indio (City of)	Indio	Riverside
Industry (City of)	Industry	Los Angeles
Inglewood (City of)	Inglewood	Los Angeles
Irvine Ranch Water District	Irvine	Orange
Jennings-Halderman-Hood	Santa Ana	Orange
Johns-Manville Fiber Glass Inc.	Corona	San Bernardino
Jones/Peterson Associates, Inc. Dick Jones	Anaheim	Orange
Kaiser Steel Corporation	Fontana	San Bernardino
Koebig & Koebig Mr. L. H.Harrison, Newport	Los Angeles	Los Angeles
KVB Engineering	Tustin	Orange
La Habra (City of)	La Habra	Orange
La Mirada (City of)	La Mirada	Los Angeles
La Palma (City of)	La Palma	Los Angeles
La Puente (City of)	La Puente	Los Angeles
Lakewood Water Department	Lakewood	Los Angeles

AGENCY	CITY	COUNTY
Laguna Beach (City of)	Laguna Beach	Orange
Lakewood (City of)	Lakewood	Los Angeles
La Verne (City of)	La Verne	Los Angeles
Lawndale (City of)	Lawndale	Los Angeles
Las Virgenes Municipal Water	Calabasas	Los Angeles
F. Beach Leighton & Associates	San Bernardino	San Bernardino
Leighton-Yen & Associates	La Habra	
Linn, Leonard, Bess, Hall, Sharky & Associates	Fullerton	Orange
Loma Linda (City of)	Loma Linda	Riverside
Loma Linda University	Loma Linda	Riverside
Lomita (City of)	Lomita	Los Angeles
Lompoc (City of)	Lompoc	Santa Barbara
Long Beach Airport	Long Beach	Los Angeles
Long Beach (City of)	Long Beach	Los Angeles
Long Beach Water Department	Long Beach	Los Angeles
Los Alamitos (City Of)	Los Alamitos	Los Angeles
Los Angeles	Los Angeles	Los Angeles
Los Angeles (City of)	Los Angeles	Los Angeles
Los Angeles Co. Flood Control District	Los Angeles	Los Angeles
Los Angeles Co. Waterworks District	Los Angeles	Los Angeles
Lowry, Engineering-Science	Santa Ana	Orange
Lynwood (City of)	Lynwood	Los Angeles
Management Center, Chapman College	Orange	Orange
Manhatten Beach (City of)	Manhatten Beach	Los Angeles
Marine Biological Consultants Inc.	Newport Beach	Orange
Marineland of the Pacific	Palos Verdes	Los Angeles
Albert C. Martin & Associates	Los Angeles	Los Angeles
Maywood (City of)	Maywood	Los Angeles
Metropolitan Water District	Los Angeles	Los Angeles
Metropolitan Water District	Yorba Linda	Orange
Metropolitan Water District of Southern California	Los Angeles	Los Angeles
Ritchie D. Mikesell, Ph.D.	Anaheim	Orange
Mines & Geology (Calif. Department)	Los Angeles	Los Angeles

AGENCY	CITY	COUNTY
Mogul Corporation of Ohio	Huntington Beach	Orange
Monitor Laboratories	San Diego	Orange* (work in)
Monrovia (City of)	Monrovia	Los Angeles
Montclair	Montclair	San Bernardino
Montebello	Montebello	Los Angeles
Monterey Park (City of)	Monterey Park	Los Angeles
Montgomery Research, Inc.	Pasadena	Los Angeles
Mosquito Abatement Dist. (Orange Co.)	Santa Ana	Orange
Moulton-Niguel Water District	South Laguna	Orange
Moulton-Niguel Water District	Laguna-Niguel	Orange
Moulton-Niguel Water & Sewage District	Laguna-Niguel	Orange
Municipal Utilities Association	Anaheim	Orange
Municipal Utilities Department	Fullerton	Orange
Navigation & Ocean Development	Sacramento	All Counties
Newport Beach (City of)	Newport Beach	Orange
Newport Beach (City of) (Planning Dept.)	Newport Beach	Orange
Noise Abatement Specialists	Santa Ana	Orange
North American School of Conservation and Ecology	Anaheim	Orange
Occupational Safety & Health Admin.	Long Beach	Los Angeles
Oceanographic Services	Santa Barbara	Santa Barbara
Ogden Laboratories	Fullerton	Orange
Olson-Horiba Inc.	Santa Ana	Orange
Olson Laboratories Henry W. Wedaa, Manager	Anaheim	Orange
Olson Laboratories	Santa Ana	Orange
Olson Northrup (Car emissions)	Anaheim	Orange
Ontario (City of)	Ontario	San Bernardino
Orange (City of)	Orange	Orange
Orange Municipal Water District	Orange	Organge
Palm Springs (City of)	Palm Springs	Riverside
Palos Verdes Estates (City of)	Palos Verdes Estates	Los Angeles
Paramount (City of)	Paramount	Los Angeles
Parks Department (Orange County)	Newport Beach	Orange
Parks & Recreation (Department of)	San Clemente	Orange
Parks & Recreation (Department of)	Goleta	Santa Barbara

AGENCY	CITY	COUNTY
Parks & Recreation (Department of)	Sacramento	All Counties
Pasadena (City of)	Pasadena	Los Angeles
Pasadena Water Department	Pasadena	Los Angeles
Personnel Department (Orange County)	Santa Ana	Orange
Philco-Ford Corporation	Newport Beach	Orange
Pico Rivera (City of)	Pico Rivera	Los Angeles
Pioneer Testing	Redlands	San Bernardino
Placentia (City of)	Placentia	Orange
Planning Department	Anaheim	Orange
Planning Department	Huntington Beach	Orange
Planning Department (Orange Co.)	Santa	Orange
POD, Inc. Woodward Dike, Principal	Orange	Orange
Pomeroy Johnson & Bailey	Pasadena	Los Angeles
Pomona (City of)	Pomona	Los Angeles
Pre-delivery Service Corp.	Los Angeles	Los Angeles
Price & Associates (H.A.)	Anaheim	Orange
Public Antiquities Salvage Team (P.A.S.T.) California State University	Fullerton	Orange
Public Health (Department of)	Berkeley	All Counties
John L. Price & Assoc.	Whittier	Los Angeles
Public Health Lab. - State	Los Angeles	Los Angeles
Radiological Health (BUreau of)	Berkeley	All Counties
Raub, Bein, Frost & Associates	Costa Mesa	Orange
Reclamation Board (State)	Sacramento	All Counties
Ralph E. Phillips, Inc. Thomas Haverty Schilling	Los Angeles	Los Angeles
Redlands (City of)	Redlands	San Bernardino
Redondo Beach (City of)	Redondo Beach	Los Angeles
Refuse Disposal Dept. (Orange Co.)	Santa Ana	Orange
Regional Water Quality Control Board	Los Angeles	Los Angeles
Regional Water Quality Control Board	Indio	Riverside
Rehabilitation, Vocational	Anaheim	Orange
Resources Agency (State)	Sacramento	All Counties
Reynolds & Associates	Newport Beach	Orange
Rialto (City of)	Rialto	San Bernardino
Richard Terry & Associates	Anaheim	Orange

AGENCY	CITY	COUNTY
Riverside (City of)	Riverside	Riverside
Riverside Medical Lab.	Riverside	Riverside
Rosemead (City of)	Rosemead	Los Angeles
Rossmore	Laguna Hills	Orange
Salkin Engineering Corporation	Orange	Orange
San Bernardino (City of)	San Bernardino	San Bernardino
San Bernardino Water Department	San Bernardino	San Bernardino
San Clemente (City of)	San Clemente	Orange
San Clemente Water & Sewage	San Clemente	Orange
San Fernando (City of)	San Fernando	Los Angeles
San Gabriel (City of)	San Gabriel	Los Angeles
Sanitary Engineering (Bureau of)	Los Angeles	Los Angeles
Sanitary Engineering (Bureau of)	San Bernardino	San Bernardino
Sanitation District (Los Angeles County)	Harbor City	Los Angeles
Sanitation District (Orange County)	Fountain Valley	Orange
San Marino (City of)	San Marino	Los Angeles
San Pedro (City of)	San Pedro	Los Angeles
Santa Ana (City of)	Santa Ana	Orange
Santa Ana River Basin, Regional Water Quality Control	Riverside	Riverside
Santa Barbara (City of)	Santa Barbara	Santa Barbara
Santa Fe Springs (City of)	Santa Fe Springs	Los Angeles
Santa Maria (City of)	Santa Maria	Santa Barbara
Santa Monica (City of)	Santa Monica	Los Angeles
Saxe Dobrin & Associates	Newport Beach	Orange
Scott Laboratories	San Bernardino	San Bernardino
Seal Beach (City of)	Seal Beach	Orange
Serendipity, Inc.	Sherman Oaks	Los Angeles
Shankman Labs	Los Angeles	Los Angeles
T.A. Shinn & Associates	Placentia	Orange
Sierra Madre (City of)	Sierra Madre	Los Angeles
Smith-Emery Company	Los Angeles	Los Angeles
Soil Conservation (Dept. of Conservation)	Sacramento	All Counties
Southern California Edison Company	Rosemead	Los Angeles
Southern California Edison Company	Huntington Beach	Orange

AGENCY	CITY	COUNTY
Southern California Water Company	Los Angeles	Los Angeles
Southern California Water Company	Los Alamitos	Orange
Southland Environmental Howard N. Fernbach	Seal Beach	Orange
Space Use Management Inc.	Fullerton	Orange
Sparklets Drinking Water	Los Angeles	Los Angeles
SRS (Spectra Research Systems, Inc.)	Irvine	Orange
Standard Oil	El Segundo	Los Angeles
Standard Oil Company of California	La Habra	Orange
State Air Resources Board	Sacramento	All Counties
State Health Department	Santa Barbara	Santa Barbara
State Lands Commissions	Los Angeles	Los Angeles
State Lands Commissions	Sacramento	All Counties
State Personnel Board	Los Angeles	Los Angeles
State Personnel Board	Sacramento	All Counties
State Water Resources Control Board	Sacramento	All Counties
Stickel & Associates	Tustin	Orange
Ralph Stone & Co.	Los Angeles	Los Angeles
Sun Electric	Maywood	Los Angeles
Systems, Science and Software	La Jolla	San Diego
Tater and Associates	Huntington Beach	Orange
Technology Associates of So. Calif., Inc.	Monterey Park	
Temple City (City of)	Temple City	Los Angeles
Termite Control (Orange County)	Anaheim	Orange
Terrametrics	Fair Oaks	
Theta Sensors	Orange	Orange
THUMS	Long Beach	Los Angeles
Truesdail Laboratories, Inc.	Los Angeles	Los Angeles
Tustin (City of)	Tustin	Orange
Twining Labs of Southern California Inc.	Long Beach	Los Angeles
Ultrachem Corporation	Walnut Creek	Los Angeles
Union Oil Company of California	Santa Fe Springs	Los Angeles
U.S. Army Corps of Engineers	Los Angeles	Los Angeles
U.S. Department of Agriculture	Tustin	Orange
Ultrasystems, Inc.	Newport Beach	Orange
Universal Interlock Inc.	Santa Ana	Orange

AGENCY	CITY	COUNTY
Upland (City of)	Upland	San Bernardino
Van Nuys (City of)	Van Nuys	Los Angeles
Vector Control (Bureau of)	Los Angeles	Los Angeles
Vehicles Emission Control Program Air Resources Board	Sacramento	All Counties
Victor Gruen & Associates	Los Angeles	Los Angeles
Victorville (City of)	Victorville	San Bernardino
Alan M. Voorhees & Associates Don Capelle	Los Angeles	Los Angeles
Water Chemists Inc.	Los Angeles	Los Angeles
Water District (Orange County)	Santa Ana	Orange
Water Resources (Department of)	Sacramento	All Counties
Water Resources (California Department of) (Mobile Equipment Services)	San Bernardino	San Bernardin
Water Resources (Department of)	Los Angeles	Los Angeles
Water Treatment Corporation	Industry	Los Angeles
Roger S. Watson	Huntington Beach	Orange
J.L. Webb Planning	Newport Beach	Orange
Weed & Vertebrate Pest Control	Sacramento	All Counties
West Covina (City of)	West Covina	Los Angeles
Western Analytical Lab	Chino	San Bernardino
Western Marine Laboratory	Santa Barbara	Santa Barbara
Westminster (City of)	Westminster	Orange
Whittier (City of)	Whittier	Los Angeles
Wilsey & Ham	South Pasadena	Los Angeles
Woodword-Envicon, Inc.	San Diego	San Diego
Yorba Linda (City of)	Yorba Linda	Orange

ENVIRONMENTAL PLANNING SERIES

	EMPLOYMENT PROJECTIONS
Land Surveyor Technican	Fair
Park And Recreation Technician	Good
Civil Engineering Technician	Good
Planning Technician	Good
Environmental Technician	Fair
Building Inspector	Fair

LAND SURVEYOR TECHNICIAN

Definition:

Works in a survey party or group engaged in difficult field or office work performing land, topographic, and construction surveys, preparation of legal land descriptions and preparation of appraisal, topographic, and record maps. Assists survey parties in conducting preliminary location, construction, property, and topographic surveys; researches records of the Federal, State, and county governments for basic information required to perform surveys or rights-of-way engineering. Assists in planning the procedures to be followed in conducting surveys. Determines the instruments to be used and evaluates the data discovered in the field. Reduces field notes, makes calculations, and alalyzes the survey data. Coordinates the field data with official records. Assists in the preparation of appraisal maps, record maps, and legal land descriptions.

Education Training Experience

Two years of college with major course work in surveying, land planning, or completion of appropriate two-year training program.

PARK AND RECREATION TECHNICIAN

Definition:

Performs a variety of duties in connection with identifying and providing methods for meeting the outdoor recreational needs for the citizens of a community. Collects, evaluates, summarizes, and analyzes outdoor recreation data from a variety of sources to identify recreational trends, existing outdoor recreational facilities, needs and deficiencies. Studies and sets up a variety of activities at parks. Supervises and instructs helpers in the management of a recreation program. Solves local recreation problems.

Education Training Experience

Completion of an appropriate training program or college level courses in park management, recreation, natural resources and physical education; plus two years of experience from similar employment or full time in park recreation.

CIVIL ENGINEERING TECHNICIAN

Definition:

Under supervision, performs rod and chain work with an engineering survey party, does routine engineering office work, and does related work as required. Serves as rodman or chainman in performing supervised work with an engineering survey party in the field. In a training capacity, may operate transits and levels as instrumentman on the survey party. Takes simple survey notes, does such engineering drawing such as tracing maps and simple construction plans and diagrams, draws details from rough layouts of simple drawings, letters either freehand or with the aid of mechanical lettering devices. Maintains drafting supplies and equipment, copies data, computes areas and tabulates readings. Makes simple mathematical computations. Traces, colors and delineates in pencil and ink, charts, graphs, base maps, proposed zoning maps, land use maps and special block studies, sketches, and other drawings. Assists in the compilation of data on special palnning projects. Assists in preparing graphs, charts, maps, sketches and other illustrated materials for preliminary reports.

Education Training Experience

Graduation from high school, including completion of courses in algebra, geometry, trigonometry and mechanical drawing. One year of experience serving as a rodman and chainman or performing engineering office work. (One year of college with major work in engineering may be substituted for the required experience.)

PLANNING TECHNICIAN

Definition:

Does planning research, assists in the preparation of planning studies, reports, plans and projects and assists in explaining the planning program, policies and regulations to the public. Assists in preparing planning studies of human, physical, natural, economic and governmental resources for the general plan. Plans to goals and policies of various government programs and analyzes possible conflicts or contradictions. The Board assists in advising the public in preparation and filing of applications for zoning changes, use variances, permits, etc. Assists in the design of land use plans in advance of development for consideration of impact of public and private construction on the quality of the environment. Assists in ecological studies. Helps prepare ordinances and resolutions to implement new planning programs. Assists in developing statistical formulas for the analysis of demographic data, analyzing and coordinating the development of computer applications.

Education Training Experience

Two years of college_level courses in public relations, basic instrumentation, biology, chemistry, conservation, ecology planning, pre-engineering, graphics, theory of design, land planning, environmental design and related courses

OR

completion of appropriate training program.

ENVIRONMENTAL TECHNICIAN

Definition:

Inspects and investigates the enforcement of ordinances pertaining to public and private property. Conducts field inspections throughout the City checking for compliance of automotive service stations and tire stores with the regulating ordinances. Conducts studies on complaints in order to seek enforcement of the noise ordinance. Investigates the claims of liability brought against the City. Makes field inspections throughout the City checking vacant lots and all improved properties for littered conditions, with particular attention being given to alleys and adjacent areas in business districts. Investigates complaints and contacts property owners and occupants regarding unsightly or neglected properties. Investigates reports of illegal dumping and similar violations. Contacts business establishments to assist in developing a proper litter removal program. Issues violation notices and compiles evidence of violations. Acts as liaison man between sanitation personnel and other City departments affected by anti-litter ordinances. Prepares reports of activities and findings. Performs related tasks as required.

Education Training Experience

Graduation from high school or its equivalent, and two years of experience involving extensive public contact, preferably related to the explanation and enforcement of established policies and the settlement of complaints. Appropriate college level courses can be substituted for the experience on a year-for-year basis.

BUILDING INSPECTOR

Definition:

Inspects building construction, substandard buildings and zoning violations for conformance with applicable city ordinances and any related duties that may be required. Inspects complaints of substandard housing, works with owners to bring buildings into conformance with the code or prepares letters of condemnation and other legal notices. Investigates zoning violations, prepares notices of violations and works with owners to alleviate non-conforming use. Makes inspections during the progress of building construction or repair to insure compliance with laws and regulations and for safe application of construction installations and practices. Interprets codes and regulations and advises on inquiries relating to construction, installation, and repair methods and materials. Makes inspection of appliances in the electrical and/or plumbing specialties and makes inspections of existing building for hazardous conditions. Looks for construction or alterations being performed without proper building permits. Investigates complaints and alleged building violations, issues permits of various kinds and accepts deposit fees, keeps records and prepares work activity reports.

Education Training Experience

Graduation from high school and three years of experience as a building inspector or an equivalent combination of education and experience. College level courses in blueprint reading, design, and pre-engineering.

POLLUTION PREVENTION SERIES

	EMPLOYMENT PROJECTIONS
Water Treatment System Operator	Fair
Water Treatment Chief System Operator	Fair
Water Treatment Operator	Fair
Water/Wastewater - Laboratory Assistant	Excellent
Grade I - Wastewater Treatment Plant Operator	Excellent
Grade IA - Wastewater Treatment Plant Operator	Excellent
Noise Abatement Technician	Excellent
Water Utilities Foreman	Fair
Sewer Maintenance Technician	Fair
Materials Testing Aide	Fair
Air Pollution Technician	Excellent
Biochemical Laboratory Technician	Excellent
Water Distribution System Operator	Poor
Water Distribution Operator	Poor
Pumping Plant Operator	Poor
Stationary Engineer	Fair
Air Pollution Chemist - Assistant	Good
Grade II - Wastewater Treatment Plant Operator	Excellent
Grade III - Wastewater Treatment Plant Operator	Excellent
Grade IV - Wastewater Treatment Plant Operator	Excellent

WATER TREATMENT SYSTEM OPERATOR

Definition:

Operates all equipment in the headhouse and supervises the operation of the filters and softeners. Regulates the flow of water and makes flow changes as required. Makes plant chemical control tests and determines chemical feeds. Maintains records and keeps the headhouse in an orderly condition. Operates and makes necessary adjustments to all equipment in the headhouse such as the chlorinators, chlorine evaporators, lime slakers, activated silica feeders, and alum feeder. Makes flow changes as required in the pipeline feeders leaving the plant. Makes chemical determinations of alkalinity, pH, chlorine residual, hardness, and turbidity or interprets the results in order to make correct adjustments of chemical dosages in the chemical feeding devices. Receives and samples lime and other chemicals delivered to the plant. Keeps a record of all flow changes in the feeders to and from the plant, and coordinates his information with others concerned with distribution system operation. Keeps the required records of chemical controls and plant operations. Supervises the operation of the softeners and the filters, and must be able to operate softener and filter equipment. Supervises the headhouse building maintenance to insure a clean and orderly condition.

Education Training Experience

A high school education or equivalent, two years experience at the level of Operator III, and six months experience in system operation. Supplementary college level courses in water chemistry, hydraulics, math, engineering or an appropriate training program are desirable with all employers and required by others.

WATER TREATMENT CHIEF SYSTEM OPERATOR

Definition:

A supervisory position involving the coordination of activities of operating personnel at the water treatment plants. Reports to the Plant Superintendent. Responsible for all phases of treatment plant operations directly related to the treatment of water. Supervises operating personnel as directed. Assists the Superintendent in establishing procedures and techniques for operation of the treatment plant facilities. Supervises those phases of plant operation related to water treatment and control, including: flows, softeners, pressures, water quality, chemical feeds, chemical deliveries, chemical inventories, and centralized control facilities. Initiates operational instructions relating to analysis of information pertaining to the plant water flow changes. Prepares work and relief schedules for all plant operators and coordinates this information with the master schedule for plant personnel.

Education Training Experience

High school education or equivalent, three years experience as a System Operator in a treatment plant or a combination of education and experience in all phases of treatment plant operations, and a Grade II Water Treatment Certificate as issued by the State Board of Public Health.

College level courses in civil or sanitary engineering, chemistry or other physical sciences are highly desirable with all employers and are required by many agencies.

WATER TREATMENT OPERATOR

Definition:

A non-supervisory position involving the operation of filters and pumps and maintaining instruments and structures. Normally includes night shift work. Operates and washes rapid san filters. Operates the pumps in the filter building and adjusts rates of flow to the wash water treatment units. Services the recording instruments and operates the hydro-pneumatic pressure water systems. Checks and monitors the automatic backwash control equipment. Operates the wash water treatment plant. Maintains the filter building or other assigned areas in a clean and orderly condition. Keeps the required records of these operations properly. Computes totals and averages of recorded data and makes out a summary of daily filter operations. Repairs pumps, feeders, chlorinating equipment, sludge collection equipment, valves, backwash controls, and other mechanical and electrical equipment.

Education Training Experience

High school diploma or equivalent and three to six months training in a lesser position. This position can lead to various higher positions with some college level courses in water chemistry, math and supervision or a training program. The higher level positions require supervisory abilities.

WATER/WASTEWATER - LABORATORY ASSISTANT

Definition:

Performs assigned standardized procedures in preparing laboratory specimens, materials, and equipment. Collects and disposes of laboratory waste material, assists with the decontamination of laboratory wastes and materials and the sterilization of laboratory materials and equipment. Assists in the cleaning of laboratory glassware, other materials and equipment and in their preparation for sterilization. Assists in distribution of laboratory glassware, instruments and other materials to assigned areas in the laboratory. Assists with preparation of specimen mailing containers and assists in the processing of incoming specimens and distributes them to the assigned areas in the laboratory. Cleans laboratory benches and other work surfaces and prepares simple solutions used for cleaning laboratory materials.

Education Training Experience

Equivalent to completion of high school. - OR - Satisfactory completion of a formalized laboratory work experience and training program of at least three month's duration, such as those conducted under Manpower Development and Training Act, Work Incentive Program, or similar work experience programs conducted by State agencies. - OR - Six months of expereince in laboratory work similar to that described above.

WASTEWATER TREATMENT PLANT OPERATOR

GRADE I

The operator who is certified at the Grade I level must assume supervisory charge of a wastewater treatment plant or a major part thereof, keep records, make reports, perform or supervise the performance of control tests, and interpret test data. Applicant must also perform related duties requiring broad knowledge of wastewater treatment plant and processes and must possess a practical knowledge of administrative, supervision, and budgeting. Must presently be employed in a wastewater treatment plant.

Education Training Experience

1. Completion of an appropriate training program plus four years experience in the maintenance and operation of a wastewater treatment plant at the Grade I level.

OR

A. Education equal to graduation from high school and seven years of progressively responsible experience in the operation and maintenance of a wastewater treatment plant or major part thereof, three years of which must have been equivalent to the experience and responsibility of a Grade II Operator, two years of which must have been at a supervisory level.

OR

B. Four years experience while in possession of a Grade II Certificate. Two years must have been at a supervisory level.

2. Successful completion of a comprehensive written examination dealing with theory and practice of wastewater treatment, maintenance and operation procedures, and the practical aspects of administration and supervision.

WASTEWATER TREATMENT PLANT OPERATOR

GRADE IA

Grade IA is an advanced technical level. Holders of this certificate must possess a broad knowledge of the theory and practice of water pollution control and wastewater treatment. Applicant shall be in responsible charge of day to day operations of a wastewater treatment plant and applicant must be thoroughly familiar with administrative and personnel procedures. Must presently be employed in a wastewater treatment plant.

Education Training Experience

1. Completion of training program plus 8 years experience in the operation and maintenance of a waste water treatment plant at the Grade IA level.

OR

A. Graduation from high school and twelve years of progressively responsible experience in the operation and maintenance of a wastewater treatment plant or major parts thereof, four years of which must be equivalent to the experience and responsibilities of a Grade I Operator while in possession of a Grade I certificate.

OR

B. A license as a professional engineer of the State of California and four years experience in supervisory charge of a Sewage Treatment Plant or major portion thereof.

OR C. Graduation from a college with a major related to the Waste Water Treatment field and four years experience in supervisory charge of a Wastewater Treatment Plant or a major part thereof.

2. Successful completion of a comprehensive written examination dealing with theory and practice of wastewater

treatment, the essentials of water pollution control, administrative and personnel procedures.

Note: Positions normally occupied by those holding the Grade IA Certificate entail the management of a large secondary wastewater treatment plant or management of a number of waste water treatment plants.

NOISE ABATEMENT TECHNICIAN

Definition:

Operates and monitors instruments and analyzers in collecting and compliling data in a program of noise abatement and monitoring. Services and operates instruments and analyzers used in noise monitoring and analysis. Operates mini computers. Repairs, calibrates and services equipment used in monitoring. Conducts field serveys. Drives equipment to service sites. Sets up and interfaces equipment at monitoring stations. May build physical and electrical models of testing equipment. May fabricate special electronic equipment. Interprets and interpolates the data for reports.

Education Training Experience

Completion of an appropriate training program or an Associate of Arts Degree in electronics. Three to five years experience in instrumentation or monitoring equipment may be substituted for the required education. A valid California Driver's License.

WATER UTILITIES FOREMAN

Definition:

Assists Water Superintendent in planning, assigning and supervision of section leaders and individual crews engaged in installing, repairing and maintaining water mains, extensions, hydrants, valves , meters, pumps and other water system equipment and facilities. Directs emergency repair of broken water mains and fire hydrants. Assists in supervision of operation and maintenance of pumping facilities and water pressure zones.

Education Training Experience

Equivalent of completion of high school, supplemented by completion of at least 3 college level courses in hydraulics and/or supervision. Four years experience in the construction and maintenance of a water utilities system, including one year of supervisory experience. Valid California driver's license. This position can lead to higher supervisory positions. Some utilities positions do not require college courses. Supervisor positions require several years of experience. The lower level of Utilities Serviceman or the equivalent of that position may require some special courses. Some plumbing experience or a training program is desirable.

SEWER MAINTENANCE TECHNICIAN

Definition:

Inspects, services and makes minor adjustments and repairs to the mechanical and electrical machinery installed in the sewage lift pump stations at various locations. Maintains, makes minor repairs, and services a number of sewage lift or pumping stations, each containing large mechanical pumping units, electric motors, appurtenant equipment and components. Cleans the premises and inside of station, washes down the wet wells, greases the packing glands and drive shafts, installs deodorizer blocks, etc., keeps all motors and pumps clean and in good operating condition. Changes charts on the recording machines which register the volume of sewage effluent being pumped at each station, and the total being pumped from the city. Makes minor repairs to the mechanical and electric equipment units. Paints the inside wall, floor and ceiling surfaces, stair railings, doors, window etc., as needed, and may perform other related and miscellaneous duties as required or directed.

Education Training Experience

High School diploma including or supplemented by two years of "trade school" level courses in mechanical-electrical subjects and at least two years of practical experience in the operation, maintenance and care of large mechanical and electrical machines, or any other equivalent combination of training and experience.

With more experience, this position can lead to supervisory positions which involves supervision of the activities listed above. License or Certificate Requirement: Valid State of California Operator's License.

MATERIALS TESTING AIDE

Definition:

Takes samples and makes routine standardized physical and chemical tests in the field or laboratory of soils, petroleum products, construction materials, sewage, and industrial waste, and inspects pipe fabrication, concrete and asphalt batching.

Education Training Experience

Two years of college education in either engineering, engineering technology, physics or chemistry. One year of full-time paid experience in making physical or chemical tests may be substituted on a year-for-year basis for each year of college education lacking. A California driver's license may be required prior to appointment.

AIR POLLUTION TECHNICIAN

Definition:

Operates and services or installs, calibrates, maintains and repairs and makes minor modifications to instruments and equipment used in air monitoring or air pollution research and testing programs. Sets up or assists in setting up air monitoring or meterological instruments and equipment at air monitoring stations. Reports data from a variety of automatic air sampling instruments. Conducts manual sampling and may perform routine analyses at location of source testing. Overhauls mechanical and electrical components of air monitoring and meteorological instruments and equipment in the shop or field. Operates and services instruments and equipment used in the field and laboratory testing of automotive emissions. Maintains records of instrument function and logs results of activities conducted. May be directed to make simple modifications of instruments or equipment to overcome operating difficulties or to obtain special information. Calibrates instrumentation. Orders supplies and requests replacement parts for instruments.

Education Training Experience

Three years experience operating and maintaining or repairing instruments used for industrial purposes, vehicle monitoring, or engineering or scientific investigations. Acceptable substitution: Completion of 60 units of a curriculum in engineering instrument-

ation, physical science or electronics in an accredited college or recognized trade school including at least 24 units in chemistry, electronics or electrical courses for two years of the required experience. Similar positions or levels may require less experience and more education, while other similar positions may require less experience and education.

BIOCHEMICAL LABORATORY TECHNICIAN

Definition:

Performs routine repetitive chemical and biochemical analyses of water or other materials. Makes routine qualitative and quantitative chemical and biochemical analyses of water, sewage, soil, cement, textiles and filler, and other materials by standardized and predetermined methods. Makes necessary arithmetical computations. Prepares standard reagents and chemical solutions, filters and weighs samples preparatory to analysis by a professional chemist. Cleans and assembles laboratory apparatus and glassware, records test data and keeps records pertaining to analyses.

Education Training Experience

Equivalent to two years of college including completion of introductory laboratory courses in organic and inorganic chemistry. Two years of experience as a technician in a chemical or biochemical laboratory.

WATER DISTRIBUTION SYSTEM OPERATOR

Definition:

Provides direct assistance to Chief System Operator involving responsibility for the operation of a designated water distribution control center. Regulates the flow of water. Maintains daily records and general system operation files. Organizes and directs the activities of operating personnel assigned to a specific water distribution control center. May treat water with chemicals. Maintains complete office files that concern flows, pressure, elevations of water in reservoirs, percent of valve opening, etc., and their relationship to the total distribution system. Reviews and evaluates various reports and studies relating to manpower, payroll, work progress etc., that relate to system operation. Anticipates flow changes by analyzing weather conditions or unscheduled operational activities. Makes necessary flow adjustments. Coordinates activities with office and field personnel and advises other facilities of flow requirements.

Education Training Experience

A high school education or equivalent, two years experience in water distribution and six months experience in system operations. Courses in hydraulics, engineering, chemistry, and supervision are desirable and may be required.

WATER DISTRIBUTION OPERATOR

Definition:

A non-supervisory position involving routine operation of a pumping plant, minor maintenance work and housekeeping duties. Normally includes night shift work. Reads indicating and recording meters, temperature and pressure gauges and water and oil level gauges. Starts and stops pumps according to schedule and assists during the execution of power switching orders. Assists in setting up and in using oils and grease equipment. Inspects equipment periodically and makes minor adjustments or reports the condition. Operates the telephone switchboard. Assists the station machinist and electricians in overhauling and repairing equipment. Checks mains, makes entries in station log book and may chlorinate water.

Education Training Experience

High school diploma or equivalent and three to six months training in a lesser position. Experience in operation of natural gas, diesel and electric pump motors. Courses in electricity and hydraulics are desireable and may be required. With increasing experience, this position can lead to higher levels that require more supervisory responsibilities.

PUMPING PLANT OPERATOR

Definition:

Plans, organizes and supervises the work of operating and maintaining water pumping facilities, consults with other water department supervisory personnel on operating conditions and water demands. Regularly inspects pumping plants and reservoirs, checking well pumps, centrifugal booster pumps and hydro-pneumatic plants. Maintains adequate water pressure throughout system and directs pump and motor installation and major repair activities. Makes visual checks to insure proper operation of telemetering equipment. Interprets plans and specifications, keeps daily records of quantity of water pumped, standing and running water level in wells and hours of pumping operation. Records power readings, keeps daily records of storage water gain or loss and takes pressure readings.

Education Training Experience

Graduation from high school and four years of increasingly responsible experience in water production work or an appropriate training program. Higher levels of this position require increasing experience and more supervisory-administrative responsibilities.

STATIONARY ENGINEER

Definition:

Operates and maintains a high pressure heating plant or a combined low pressure heating and refrigeration plant. Watches, maintains, and tests high and low pressure boilers, refrigeration, air conditioning and auxiliary plant equipment which does not exceed in boiler capacity 500 h.p. or a total refrigeration capacity of 1200 tons. Operates, maintains, repairs, and inspects manual and semi-automatic gas and oil fired high or low pressure steam or hot water boilers. Operates, maintains, repairs and inspects motors, turbines and steam-driven equipment, steam reducing stations, expansion tanks, air compressors, supply and exhaust fans, various kinds of pumps and valves, steam traps, water treatment systems, water heaters and other heating plant auxiliary equipment. Adjusts, maintains, tests and calibrates boiler and air-conditioning machinery and mechanical, electrical or pneumatic control intruments and safety devices. Tests boiler water, condensate, cooling tower water and water from other systems and adds corrective chemicals. Keeps logs of plant operations and records maintenance and repair work performed. May operate, maintain, inspect and repair reciprocating central air-conditioning machinery including condensers, evaporators, cooling towers, pumps, purge tanks and related equipment. May test, operate and maintain emergency diesel powered electric generating equipment.

Education Training Experience

One or two years of college with major course work in pre-engineering refrigeration and steam plant operation. Two years experience in the operation and maintenance of high or low pressure gas or oil fired boilers and auxiliary equipment. May need knowledge of gas or dies l powered equipment. California Class "3" Driver's License and Limited Steam Engineer's License.

AIR POLLUTION CHEMIST - ASSISTANT

Definition:

Analyzes the composition of compound substances using standardized chemical tests and assists with the adaptation and development of required instruments. Assists in performing chemical analysis of samples taken in connection with air monitoring, industrial source testing, automotive exhaust research and other air pollution problems. Learns and utilizes a variety of instrumentation equipment and techniques to analyze samples by gas chromatography, spectroscopy and the total combustion analyzer and calibrates these instruments. Performs the more standardized tests, or portions of tests, utilizing such techniques as titrating, pipetting, distilling, refluxing, filtration, precipitations and other chemical procedures normally utilized in college level laboratories. Using the analytical balance and the micro balance, weighs out materials. Assists more experienced personnel in the investigation on non-standard analytical problems requiring advanced knowledge and techniques of chemistry or physics. Assists with the adaptation, modification and construction of laboratory equipment and instrumentation. Prepares chemical solutions and reagents in required form. Writes reports and maintains laboratory records and results of analyses. Maintains laboratory and analytical instruments in a clean and operative condition.

AIR POLLUTION CHEMIST - ASSISTANT (Cont'd)

Education Training Experience

Two years of college with specialization in chemistry, physics, or completion of an appropriate training program. This can lead to several higher level positions with further course work in the above mentioned areas or completion of a Bachelor of Science degree.

WASTEWATER TREATMENT PLANT OPERATOR

GRADE II

The operator at the Grade II level will be expected to operate and maintain a wastewater treatment plant, keep records, prepare reports, perform and interpret control tests, and execute related duties requiring a practical knowledge of a treatment plant and processes. Applicant will be expected to assume administrative and supervisory responsibility for subordinate personnel. Applicant may demonstrate his right to certification as a Grade II Operator by having worked at least three years at this level of responsibility and by having prepared himself through more extended experience at lower levels of responsibility. Must presently be employed in a wastewater treatment plant.

Education Training Experience

1. A. Completion of an appropriate training program plus three years experience at the Grade II level.

OR B. Education equal to graduation from high school, possession of a Grade III Certificate for two years, and performance of the functions of a Grade II Operator as outlined above, currently, or at a previous time of employment.

OR C. Performance of the functions of a Grade II Operator as outlined above for a period of at least three years while in possession of a Grade III Certificate.

WASTEWATER TREATMENT PLANT OPERATOR (Cont'd)

GRADE II

2. Successful completion of a written examination concerning the fundamentals of waste treatment theory, practice and practical operation.

3. Oral exam required under 1 A.

WASTEWATER TREATMENT PLANT OPERATOR

GRADE III

The operator who is qualified at the Grade III level will be expected to be capable of operating and maintaining a waste water treatment plant or major parts thereof, keeping simple records, performing and interpreting simple control tests, and performing related duties requiring a knowledge of the fundamentals of sewage treatment. Must be presently employed in a wastewater treatment plant.

Education Training Experience

1. A. Performance of the functions of a Grade III Operator as listed above for a period of three years.

OR B. Possession of education equivalent to graduation from high school supplemented by college level courses in appropriate subjects and two and one-half years full-time experience in actual operation and/or maintenance of a wastewater treatment plant.

OR C. One and one-half years experience while in possession of a Grade IV Certificate.

2. Successful completion of a written examination and interview to demonstrate fundamental knowledge in the following areas as they pertain to wastewater treatment plants:
   a. Functions of the plant components.
   b. Normal performance characteristics of commonly used

primary and secondary treatment processes.

c. Routine service and care of equipment.

d. Routine tests for evaluation of plant performance.

e. Plant and personnel safety procedures.

WASTEWATER TREATMENT PLANT OPERATOR

GRADE IV

The operator who is qualified for certification at the Grade IV level will be expected to operate and/or properly maintain wastewater treatment units in the plant where applicant is employed. Must presently be employed in a waste wat eatment plant.

Education Training Experience

1. Completion of one year full-time employment in actual operation of a wastewater t.eatment plant.
2. Demonstration of an overall working knowledge of the unit operations of the wastewater treatment plant where applicant is employed.
3. Provided that the applicant be currently or previously has been employed in a wastewater treatment facility, education may be substituted for experience up to a maximum of six months.
4. The candidate shall satisfactorily complete an oral and written examination.
5. When using educational points, applicant must have six months full-time experience.

DISEASE PREVENTION/SAFETY AND HEALTH SERIES

	EMPLOYMENT PROJECTIONS
Sanitary Engineering Technician	Good
Pest Control Technician	Fair
Public Health Sanitarian Assistant	Fair
Occupational Safety & Health Technician	Excellent
Industrial/Clinical Hygienist	Fair
Environmental Inspector	Fair

SANITARY ENGINEERING TECHNICIAN

Definition:

Assists in performing sanitary engineering tasks in connection with water supply and sewage, waste disposal, water quality and other public health fields. Makes surveys, inspections, and reports on water supply and treatment works, the pollution or water quality of streams and other bodies of water, and on sewage and industrial waste treatment and disposal. Assists in making investigations, prepares reports and recommendations for approval of supervising engineers on treatment of wastes to prevent pollution or unsanitary conditions. Cooperates with local health departments and other agencies on water quality and environmental sanitation problems. Assists on operational problems for water and sewage systems, supervises the inspection of recreational areas in counties having no health departments, investigates complaints of unsanitary conditions or water quality degradation and makes recommendations for prevention and abatement. Makes and checks sanitary engineering calculations, designs, drawings, and maps.

Educational Training Experience

Four years of full-time paid engineering experience with high school diploma in one or a combination of the following:

Technical investigations, inspections or reports on water supply, water quality, sewage and waste disposal, or air sanitation--OR--The preparation or review of sanitary engineering plans, estimates, and specifications.--OR--Gathering, compiling and analyzing sanitary engineering data. College-level courses in drafting, engineering, waste treatment, water quality can be substituted for the experience on a year-for-year basis.

PEST CONTROL TECHNICIAN

Definition:

Performs journeyman work in the eradication and control of field rodents and noxious weeds and supervises a small crew engaged in this work on a seasonal basis. Supervises and participates in setting traps and putting out poison bait for field rodents. Supervises and participates in treating rodent burrows with lethal gases. Supervises and participates in the destruction of noxious weeds by digging, burning, or spraying with chemical herbicides. Observes and identifies common field rodents and noxious weeds and reports evidence of infestation. Assists agricultural inspection personnel in the inspection of properties in searches for agricultural pests. Uses fire arms in the eradication of field rodents. Transports and issues equipment, materials and supplies. Maintains and makes minor repairs to equipment and keeps work records.

Education Training Experience

Six months' experience in the eradication and control of field rodents and noxious weeds or completion of appropriate training program. California Class "3" Driver's License or its equivalent.

PUBLIC HEALTH SANITARIAN ASSISTANT

Definition:

Assists with general sanitary inspection work such as buildings, dwellings, and land for rodents, insects, improper disposal of garbage, rubbish and sewage, and other unsanitary conditions. Assists in the inspection of food establishments and restaurants for proper sanitary conditions. Participates in communicable disease investigations as related to environmental sanitation. Assists in sanitary surveys of geographical areas. Investigates vector control problems related to flies, mosquitoes, other insects, and rodents, and makes recommendations or issues written notice to correct conditions. Assists in the investigations of complaints and violations of public health laws. Assists in the preparation of cases for prosecution in connection with enforcement work. Keeps inspection records and prepares reports.

Education Training Experience

Two years of college with course work in the basic sciences or completion of a training program. Ability to speak Spanish is an advantage. With further course work in the sciences or completion of a Bachelor of Science degree, this position can lead to higher level positions.

OCCUPATIONAL SAFETY & HEALTH TECHNICIAN

Definition:

Assists in planning and conducting technical and laboratory work related to the study, evaluation, and control of potential occupational health hazards in the work environment. Conducts studies of work environments which adversely affect employees in terms of morale, absenteeism, or turnover, and makes recommendations for remedial action. Reviews occupational disease reports and Clinical or health records to aid in conducting epidemiologic studies among worker group areas to identify sources of work-generated illness. Collects samples of suspected contaminants, makes dust counts, and collects data from instrument readings to quantify the amount of specific contamination. Studies and evaluates industrial processes to determine at which points in the process health might become impaired because of inhalation, ingestion, or skin absorption of toxic substances. Compares findings with established safe levels to determine if exposures are within permitted range or are excessive and hazardous. Recommends the most practicable corrective measures to eliminate or control the potential occupational health hazards in the work environment. Calibrates, operates, and maintains industrial hygiene instruments and testing equipment. Consults supervisors regarding behavioral characteristics of work teams, work pressures, and cohesiveness of employee teams. Prepares reports of the results of special occupational hygiene studies.

Education Training Experience

Completion of an appropriate training program or years experience combined with college level courses in occupational safety and health, mathematics, chemistry, industrial hygiene and safety and health standards.

INDUSTRIAL/CLINICAL HYGIENIST

Definition:

Performs sub-professional technical duties in the occupational health program. Takes and records audiometric tests. Describes ear protection devices. Uses Orthorator and projector to screen vision. Takes and mounts electrocardiograph tracings. Provides instructions and information to patients regarding the examination process. Calibrates examination equipment and reports deficiencies. Keeps record on material issued and initiates requests for requisition to maintain stock and inventory control. Collects specimens for urinalysis and conducts simple screening tests. Takes and records blood pressures. Cleans, maintains and sterilizes surgical instruments. May perform any of the duties of a Senior Attendant. May perform incidental clerical duties.

Education Training Experience

One year's experience taking audiometric tests or completion of an appropriate training program.

California Class "3" Driver's License may be required for some assignments.

ENVIRONMENTAL INSPECTOR

Definition:

Inspects and investigates the enforcement of ordinances pertaining to public and private property. Conducts field inspections throughout the City checking for compliance of automotive service stations and tire stores with the regulating ordinances. Conducts studies on complaints in order to seek enforcement of the noise ordinance. Investigates the claims of liability brought against the City. Makes field inspections throughout the City checking vacant lots and all improved properties for littered conditions, with particular attention being given to alleys and adjacent areas in business districts. Investigates complaints and contacts property owners and occupants regarding unsightly or neglected properties. Investigates reports of illegal dumping and similar violations. Contacts business establishments to assist in developing a proper litter removal program. Issues violation notices and compiles evidence of violations. Acts as liaison man between Sanitation personnel and other City departments affected by anti-litter ordinances. Prepares reports of activities and findings. Performs related tasks as required.

Education Training Experience

Graduation from high school or its equivalent, and two years of experience involving extensive public contact, preferably related to the explanation and enforcement of established policies

and the settlement of complaints. College-level courses in environmental science, safety, health, noise abatement, and civil and local laws may be substituted for the experience on a year-for-year basis.

ENVIRONMENTAL ECOLOGICAL RESOURCES SERIES

	EMPLOYMENT PROJECTIONS
Park Animal Keeper	Poor
Dredge Master	Poor
Meterologist Assistant	Fair
Feed And Agricultural Chemicals - Inspector	Good
Grounds Man	Good
Hydographer - Assistant	Good
Engineering Technician (Soil)	Fair
Fish and Game Technician	Fair
Tree Crew Leadman	Fair
Marine Technician	Fair
Agricultural Technician	Poor
Conservation Warden	Poor
Park Ranger Trainee	Good
Water Resources Technician	Poor
Weed Sprayer	Poor
Feed And Agricultural Chemicals - Inspector	Poor
Dam Operator Assistant	Poor

PARK ANIMAL KEEPER

Definition:

Supervises and participates in the care of exhibited animals and birds at a regional park, zoo or primate enterprise. Supervises and participates in the care of animals and birds, such as horses, buffalo, sheep, reindeer, goats, rabbits, pigs, cows, pigeons, ducks, chickens, peacocks and pheasant, exhibited at a regional park. Feeds and waters animals and birds, determining the proper apportionment of food. Cleans and disinfects stables, pens, cages and feeding equipment. Maintains good physical appearance and comfort of animals by currying horses, filing animals' teeth, trimming feet of hoofed animals, trimming sheep's wool, applying eye ointment, and performing related duties. Inspects animals for disease or injury, assists in administering first aid treatment, and ensures special care when indicated. Moves animals from one enclosure to another as required, and prepares animals to be transported from park. Enforces safety regulations for park visitors in proximity of animal exhibits. May provide information to park visitors regarding exhibited animals. Plans and schedules work in relation to park hours and anticipated peak visiting periods. Trains and supervises helpers. Orders and maintains supplies used in feeding and care of animals. May assist animals in giving birth to young.

Education Training Experience

Six months' experience caring either for farm animals or for exhibited animals in a zoo, circus, amusement park or similar operation.-OR- Training and education in appropriate educational program.

DAM OPERATOR ASSISTANT

Definition:

Assists in the operation and maintenance of a Flood Control District dam or of a group of debris dams and basins. Operates manual and hydraulic dam outlet valves, computing inflow and outflow rates and making required adjustments in valve openings. Records and assists in preparing reports from data pertinent to dam operations such as temperature, precipitation and evaporation rates, reservoir water surface elevation and storage, and dam leakage. Operates a radiotelephone to report on dam operations during storms. Maintains and makes minor repairs to valves, pumps, generators, hoists and guages. Maintains and makes minor repairs to dams and appurtenant structures and equipment including water systems, buildings, fences, trails, and trashracks. Maintains grounds in a clean and orderly condition. Patrols area to prevent trespassing and vandalism. Patrols a group of debris dams and basins during storms, recording water surface elevation and rain guage readings and noting and reporting slides or hazardous debris accumulation. Operates a boat to patrol reservoirs and boom debris. Acts as relief dam operator.

Education Training Experience

Completion of an approved training program of at least six months duration in the maintenance and operation of flood control dams and debris and basins. California Class "3" Driver's License or its equivalent.

Two other similar positions require 1 and 2 years of experience.

DREDGE MASTER

Definition:

Supervises the harbor dredge operations in accordance with standard dredging operating procedures, determines location of dredge for daily dredging assignments, assigns cutting depth in each location, maintains progress reports, daily activity reports and prepares special reports as required, supervises the annual maintenance of equipment, establishes and maintains preventive maintenance programs for the operational equipment of the dredge, supervises and schedules the activities of assigned personnel, prepares the Division annual budget.

Education Training Experience

Graduation from high school, combined with special training in hydraulics and mechanical engineering, heavy equipment maintenance and boating or navigation.

Four years of dredging operations experience, preferable with one year of supervisory experience in the operation of a 12" dredge.

METEOROLOGIST ASSISTANT

Definition:

Collects and analyzes meteorological data, makes forecasts, prepares weather charts, or makes investigations relating meteorological data to the problem of air pollution control. Makes detailed forecasts of expected weather and air pollution conditions for periods of up to 48 hours duration and more general forecasts for longer periods. Prepares streamline charts from charts of plotted wind direction and speed, isobaric analyses of pressure and wind systems, frontal analyses and other weather charts and maps as directed. Analyzes series of hourly maps to provide air parcel-time trajectories. Correlated meteorological data such as the height of the temperature inversion with reported concentrations of air pollutants and prepares charts and diagrams showing interrelationships. Plots wind and other meteorological data. Conducts research projects as assigned and prepares related technical reports.

Education Training Experience

Two years of experience in meteorology or training at an approved school or college, or military training in meteorology.

FEED AND AGRICULTURAL CHEMICALS - INSPECTOR

Definition:

Does inspection and sampling work involved in the enforcement of laws relating to spray residue, manufacture and sale of commercial feeds, fertilizing materials, injurious materials, pesticides, and livestock remedies. Inspects and samples fresh and dried fruit and vegetables to determine amount of spray residue present and makes simple titration tests and spray residue analyses. Inspects and samples commercial feeds, fertilizing materials, injurious materials, pesticides, and livestock remedies to insure that labeling or branding is legal, and that materials conform in strength and quality to the labels and claims made by the manufacturers, dealers, or salesmen. Interviews and consults with farmers and merchants to determine causes of violations and to advise on methods of avoiding future violations and insures that dealers are licensed. Investigates alleged violations of the law, collects delinquent tonnage reports and license fees. Prepares reports.

Education Training Experience

Completion of 2-year agricultural program at accredited college or school - or two years experience performing inspecting functions plus college with courses in chemistry, agriculture, plant entomology and fertilizers.

GROUNDSMAN

Definition:

Performs gardening and general grounds maintenance work and supervises helpers. Plants, cultivates, waters and sprays ornamental plants, shrubs, hedges, trees and flowers, and propagates cuttings. Plants and cares for lawns and maintains plants along highways and in semiarid regions. Performs general grounds maintenance work and prepares and treats soils for planting and spades and fertilizes flower beds and sets out plants. Determines treatment of plant diseases. Establishes program for cultivating, fertilizing and maintenance. May supervise ground maintenance crew or keep greenhouses and other buildings in repair and free from diseases and pests.

Education Training Experience

Three years of full-time experience in flower gardening and general grounds maintenance work or completion of a two-year college level. This position can lead to several other positions of a supervisory nature.

HYDROGRAPHER - ASSISTANT

Definition:

Collects, computes and tabulates hydrologic data and records, and performs hydrologic studies. Compiles, and tabulates hydrologic data and records, and prepares reports and studies. Maintains files of such data, records, reports and studies. Plots rainfall information and draws isohyetal maps; plots flooded and burned areas on topographic maps from field observations. Prepares hydrographs indicating reservoir storage, dam leakage, and underground water levels. Makes and checks office computations for determining water flows from records. Measures rainfall. Makes snowpack measurements, obtains snow samples and makes related computations. Makes leakage observations at dams and prepares written reports. Determines cross-sections and profiles of streams, channels, spreading grounds, and canyons for calculating flows, storage capacity, debris build-up, etc. Measures wells. May obtain water samples from observation wells. May perform routine chemical tests of water samples. Checks and computes flows, and regulates and routes the flow of water in spreading grounds. Provides direction to other employees. Monitors the level of insect infestation around spreading facilities.

Education Training Experience

Completion of appropriate training program or 3 years experience supplemented by college-level courses in hydraulics, hydrography, mathematics drafting, technical writing, water chemistry and pre-engineering

ENGINEERING TECHNICIAN (SOIL)

Definition:

Assists field or office engineering personnel in performing such duties as surveying, soil mechanics laboratory testing, inspection of construction operations, filing records, and drafting. Assists engineering personnel in routine non-technical work as required. May perform various tasks in soils mechanics laboratory, such as preparing and processing soil specimens, assisting in testing procedures, and taking care of laboratory equipment. May assist with minor duties in connection with inspection of construction operations, including keeping routine records. May assist in upkeep of drafting room files, drawings and other engineering records, and perform minor drafting work. On survey parties, acts as chainman or rodman and assists in accurate measurements of distances. Uses stadia or leveling rod selecting proper points for rod readings. Sets and marks stakes or monuments required by the survey. Clears line of sight for instrument readings and measurements. Maintains tools and equipment in good condition. May assist chemists in chemical and bacteriological laboratories as required, performing routine housekeeping and test solutions.

Education Training Experience

Completion of one semester of college drafting, agriculture, biology, geometry plus six months recent experience.

FISH AND GAME TECHNICIAN

Definition:

Performs and assists in the supervision of the construction, installation, and maintenance of fish screens, ladders, and traps and is responsible for the fabrication, maintenance and operation of support equipment and gear for a fisheries research or management program. Assists in planning, organizing and supervising the activities of a fish screen and ladder shop. Supervises and assists in the design, construction, installation, maintenance and repair of fish screens, ladders, traps, and small flow maintenance dams. Selects materials, lays out patterns and templates, schedules fish screen check routes, supervises and performs stream and lake improvement work. Operates various wood and metal power tools, supervises and performs fish rescue work, supervises and performs the fabrication of various fisheries research apparatus, gear, and special equipment such as nets, sample boxes, pumps and winches. Operates small boats, fabricates parts for mechanical screening and fish sampling devices, maintains nets, boats and equipment. May assist research personnel on field surveys in the collection of data.

Education Training Experience

Completion of an appropriate training program plus one year of experience in the natural resources field such as parks, forestry or fish and wildlife, performing construction and maintenance work on habitat development projects, at least one year of this experience must have been as a supervisor or leadman. (Additional qualifying general experience may be substituted for the required education on a year-for-year basis.)

TREE CREW LEADMAN

Definition:

Supervises and assists a tree trimming crew in work of trimming, shaping, pruning, topping, bracing and removing street and park trees and bushes. Specifies what limbs to cut, special rigging to make, and how trees should be removed. Personally performs the more difficult or skilled work, such as cabling and removing diseased, dead or excess limbs or branches. Performs basic tree surgery, operates truck, sprayers, saws and a variety of other equipment involved in the work and is responsible for the maintenance on the job of all such tools and equipment.

Education Training Experience

Combination substantially equivalent to completion of the 12th grade. Each year of college majoring in ornamental horticulture may be substituted for each year of experience. Three years experience in trimming, cultivating and care for ornamental and shade trees. Valid California Operator's License.

MARINE TECHNICIAN

Definition:

Assists professionals in making observations and recording chemical and biological data. Takes temperature of the sea and air under various conditions and at various water depths. Collects and prepares samples of water for chemical analysis. Collects and inspects samples of sea life, including micro-organisms. Assists in the processing of data from observations and research. Operates and calibrates a variety of instruments and may dive using a variety of scuba gear.

Education Training Experience

A minimum of two years of college in marine technology or completion of special training program.

Diving experience or ability and strong physical condition is important.

AGRICULTURAL TECHNICIAN

Definition:

Supervises workers in livestock production, crop production or field irrigation work. Trains and supervises inmate workers in general farming and livestock work and in the operation and maintenance of farm tools and equipment. Supervises day-to-day maintenance of the hog farm or beef cattle herd, including proper feeding, breeding activities, health care, notching or branding, preparing animals for shipping, and cleaning of stables, corrals, troughs or pens. Supervises irrigation of alfalfa fields and pasture land. Supervises planting, cultivating, weeding, fertilizing, harvesting and storing of vegetables or forage crops. Maintains records regarding workers, irrigation schedules, identification and breeding of livestock, etc.

Education Training Experience

Completion of two years in an accredited college with specialization in agriculture. Each year's experience in general farming or livestock work, which must have included supervision of others, will be accepted for each year of college.

With more experience in supervision, this position can lead to Senior Farm Foreman.

CONSERVATION WARDEN

Definition:

Patrols assigned areas to prevent fish and game violations. Issues warnings and citations, makes arrests, investigations and testifies in court. Patrols an assigned area by motor vehicle, boat, aircraft, horse or on foot. Inspects crop damage by wildlife, issues permits for hunting predators. Speaks at meetings and explains fish and game laws. Assists in wildlife management and performs rescue operations. Supervises hunter safety programs. Investigates reported violations, apprehends violators and serves warrants.

Education Training Experience

Two years of college with courses in biological sciences, fish and wildlife management, conservation or police science or two years experience in law enforcement work.

PARK RANGER TRAINEE

Definition:

Assists with the routine duties of park operations and maintenance and participates in a planned training program structured to teach the methods and procedures of park operations and maintenance. Assists in the gathering of data and the development of recommendations concerning park ground utilization and development, plumbing and irrigation systems, waste disposal methods and techniques, and playground equipment. Becomes knowledgable of the methods and practices of grounds maintenance, installation, maintenance and repair of park plumbing and irrigation systems, operation of power equipment and hand tools;knows procedures of waste control and disposal, techniques employed in soil erosion control; methods and practices used in construction, installation, and repair of park facilities, structures, and playground equipment. Needs knowledge of standard terms and conditions of concessionaire contracts, construction contracts, coordinating parks work with County departments. Fundamental knowledge of local flora and fauna, and participates in the installation, maintenance and care of such park features as exhibits, nature trails, and small zoos; give talks to groups and makes speeches.

Education Training Experience

Completion of two years college study preferably with 20 semester units in park management, horticulture, forestry, landscape architecture, business management or a closely related field. Possession of a valid California Driver's License.

This entry level position can lead to the Ranger position with increasing amounts of supervision and responsibility.

WATER RESOURCES TECHNICIAN

Definition:

Does complex non-professional engineering work in any phase of water resources programs. Makes inspections for compliance with plans and specifications of a variety of construction or maintenance projects such as buildings, bridges, roads, wharves, piers, dams, aqueducts, levees, jetties, groins, retaining walls and similar structures. Makes field and laboratory tests on construction materials or water samples, assists with foundation and hydraulic investigations and makes routine engineering calculations. Assists with design work, plans, estimates, reports, and specifications. Distributes the water of a stream system or ground water basin in accordance with agreements or court orders. Installs, calibrates, operates, and maintains water measuring devices, makes current meter measurements, computes stream flow, and rates gauging stations. Participates in snow surveys, and in ground water, crop, land use, and irrigated area investigations. Prepares reports and memoranda. Acts as instrumentman or recorder in a survey party and may use underwater diving equipment in connection with underwater inspection and repair of structures and facilities of the State Water Project.

Education Training Experience

Two years of college level courses in areas such as agricultural engineering, pre-engineering and irrigation or completion of an appropriate two year program.

WEED SPRAYER

Definition:

Operates an agricultural sprayer to control annual and perennial weeds; identifies weeds and determines applicable spray remedy; prepares and sprays herbicides; drives and performs routine maintenance of spray unit and pickup truck; instructs and directs work of an assistant; informs supervisors of quantities and types of sprays needed; maintains records of work assignments.

Education Training Experience

College level courses in agriculture, chemistry or related fields are desirable plus two years of horticultural or tree maintenance experience and possession of a valid Class 3 California Driver's License and pass a yearly physical exam.

UNIVERSITY OF CALIF.
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